DOCUMENT RESUME

ED 197 976 SE 034 143

AUTHOR	Cashell, Jane G.: And Others
TITLE	An Evaluation of the National Science Foundation Comprehensive Assistance to Undergraduate Science Education Program, Volume III: Broad View of CAUSE Projects.
INSTITUTION	Development and Evaluation Associates, Inc., Syracuse, N.Y.
SPONS AGENCY	National Science Foundation, Washington, D.C. Directorate for Science Education.
PUB DATE	[80]
CONTRACT	NSF-SER-7309547
NOTE	191p.: For related documents, see SE 034 140-142.
EDRS PRICE	MF01/PC08 Plus Postage.
DESCRIPTORS	College Science: Educational Improvement: Evaluation Methods: *Federal Programs: Higher Education: *Program Evaluation: Science Education: *Science Instruction: *Surveys: *Undergraduate Study
IDENTIFIERS	National Science Foundation

ABSTRACT

Presented is the third in a three-volume report detailing the evaluation of the National Science Foundation Comprehensive Assistance to Undergraduate Science Education (CAUSE) program, a program developed to encourage the improvement in quality and effectiveness of undergraduate science education in institutions of higher education. This volume contains analyses of data gathered using the broad focus techniques of evaluation. Chapter One provides a detailed description of results of two surveys of CAUSE project directors as well as conclusions regarding sections of the surveys in which questions were asked about project implementation, project impact, evaluation, and overall project success. Results of a content analysis of funded proposals in the CAUSE project are presented in Chapter Two. Infotmation is provided relevant to certain aspects of the evaluation issues of concern, with a primary purpose of the content analysis of funded proposals being to provide baseline data to support and drive other baseline activities. (CS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED197976

SE

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY
Joel B. Aronson
of the NSF

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

AN EVALUATION OF THE NATIONAL SCIENCE FOUNDATION COMPREHENSIVE ASSISTANCE TO UNDERGRADUATE SCIENCE EDUCATION PROGRAM

Jane G. Cashell and John D. Eggert
Project Co-Directors

VOLUME III:
BROAD VIEW
OF CAUSE PROJECTS

Prepared for:
Office of Program Integration
Directorate for Science Education
National Science Foundation
Washington, D.C. 20550

DEVELOPMENT & EVALUATION ASSOCIATES, INC.
4836 Westfield Drive, Manlius, New York 13104

SE 034 143

This report is based upon work supported by the National Science Foundation under contract number SER-7809547. Any opinions, findings, conclusions, and recommendations expressed herein are those of the authors and do not necessarily reflect the views of the National Science Foundation.

PERSONNEL ROSTER

An Evaluation of the CAUSE Program

Evaluators and Report Authors - Development & Evaluation Associates, Inc.

Jane G. Cashell, Project Co-Director
John D. Eggert, Project Co-Director
Richard M. Lent, Research Associate
Terry Coleman, Research Associate
Kathleen Porter, Research Associate
Jody Karen Witham, Research Assistant

Project Staff

Marti Haggerty, Business Manager
Betty Kuttruff, Secretary
Jan Sernett, Administrative Assistant
Susan Koprowski, Project Secretary

Science Consultants

Thomas Allen, Professor of Chemistry
Hudson Valley Community College
Jacquelyn L. Beyer, Professor of Geography and Environmental Studies
University of Colorado at Colorado Springs
David P. Butts, Professor of Science Education
University of Georgia
Esther Lee Davenport, Research Engineer
Georgia Institute of Technology
Marvin Druger, Professor of Biology
Syracuse University
James J. Gallagher, Director, Science and Mathematics Teaching Center
Michigan State University
Ramesh Gaonkar, Professor of Electrical Technology
Onondaga Community College
John E. Penick, Associate Professor of Science Education
University of Iowa
Spencer Swinton, Research Psychologist
Educational Testing Service
Robert E. Yager, Professor of Science Education
University of Iowa

Cost Analysis Consultants

Albert Beilby, Assistant to the Director, Office of Library Services,
Central Administration, State University of New York
Philip L. Doughty, Associate Professor of Instructional Design,
Development & Evaluation, Syracuse University
Peter A. Stace, Assistant Dean, College of Arts and Sciences
Syracuse University

TABLE OF CONTENTS - VOLUME III

Page

INTRODUCTION TO VOLUME III. 1

CHAPTER ONE - Survey of CAUSE Project Directors, 1976-78. 3

- Summary of the Chapter. 3
- Development and Procedures of the Survey. 4
- Summary of Findings 10
- Results of the First Survey 24
  - Project Implementation. 24
  - Project Impact. 31
  - Project Evaluation. 39
  - Overall Project Success 42
- Results of the Second Survey. 59
  - Project Characteristics 59
  - Project Implementation. 70
  - Project Impact. 84
  - Project Evaluation. 102
  - Recommendations 103

CHAPTER TWO - Content Analysis of Funded Proposals, 1976-79 131

- Purpose of the Content Analysis 131
- Derivation of Content Analysis Procedures 132
- Data Collection 138
- Results of the Content Analysis 140
  - Total Frequencies for All Variables 140
  - An Analysis of Variables Over Project Years 161
  - An Analysis of Variables By Institution Type. 172

REFERENCES. 185

LIST OF TABLES - VOLUME III

Table		Page
1	Comparison of Responses to Questions Which Appeared on Both Survey One and Survey Two.	21
2	Survey of CAUSE Project Directors, Percentages of Response, Spring 1979.	47
3	Survey of CAUSE Project Directors, Percentages of Response, Fall 1979.	109
4	Institution Type of CAUSE Projects.	141
5	Disciplinary Focus of CAUSE Projects.	142
6	Target Audiences of CAUSE Projects.	143
7	CAUSE Project Funding	145
8	Problems and Science Education Needs.	146
9	Goals and Objectives of CAUSE Projects.	147
10	Outcomes of CAUSE Projects.	149
11	Primary Outcome of Each CAUSE Project	150
12	Faculty Development Projects.	152
13	Individualization/Remediation Projects.	153
14	Curriculum Addition/Revision Projects	156
15	Use of Computer Projects.	157
16	Equipment and Facilities Projects	159
17	Institution Type by Project Year.	162
18	Disciplinary Focus by Project Year.	163
19	Target Audience by Project Year	164
20	Funding by Project Year	165
21	Problems and Science Education Needs by Project Year.	167
22	Goals and Objectives by Project Year.	168

LIST OF TABLES - VOLUME III (cont'd)

Table		Page
23	Outcomes by Project Year	169
24	Primary Outcome by Project Year	170
25	Disciplinary Focus by Type of Institution	176
26	Target Audience by Type of Institution	177
27	Funding by Type of Institution	178
28	Problems and Science Education Needs by Type of Institution	179
29	Goals and Objectives by Type of Institution	181
30	Outcomes by Type of Institution	182
31	Primary Outcome by Type of Institution	183

VOLUME III

BROAD VIEW OF CAUSE PROJECTS

Introduction to Volume III

Kathleen Porter

The CAUSE program is four years old. A program evaluation has been conducted with the aim of refining and improving the CAUSE program. This evaluation provides a description and analysis of the CAUSE program. The specific issues of the evaluation are: (1) the extent to which high priority local college and university needs are being met by local CAUSE projects; (2) the ways in which CAUSE projects are being implemented; (3) the extent to which instructional improvement is resulting from CAUSE; (4) the nature and use of evaluation data on CAUSE projects; (5) the relative costs of the functional activities of CAUSE projects and how they relate to post-CAUSE institutional support; and (6) program changes and modifications to be made in the CAUSE program.

This volume contains analyses of data gathered using the broad focus techniques of the evaluation. In contrast to the narrow in-depth focus provided by the eight case studies of CAUSE projects and the somewhat broader focus provided by the 17 site visits, the activities described in this volume - the analysis of 273 funded CAUSE proposals, and the surveying of 201 CAUSE project directors - provide a broad view of all the CAUSE projects funded between 1976 and 1978.

The data gathered from the CAUSE proposals and from the survey of project directors have been aggregated for the purpose of discovering trends. As with most quantitative methods, these were utilized for the purpose of justifying broad statements about CAUSE projects. In contrast, the qualitative methods used in the site visits and the case studies were sensitive to peculiarities and individual differences.

The broad focus evaluation relied upon a quantitative content analysis of CAUSE proposals and the use of programs in SPSS (Statistical Packages for the Social Sciences) for analysis of the survey of project directors. In contrast, the narrow and medium focus evaluations relied upon observation.

The content analysis of CAUSE proposals provides an overview of the way projects were described before they were implemented. It portrays the intended recipients of the benefits of the proposed projects; it describes the needs as they were perceived by the proposers; it displays the goals and objectives of the proposed projects; it portrays the proposed strategies for meeting needs and realizing goals.

The survey of CAUSE project directors, on the other hand, portrays the projects as seen by project directors either during implementation or after project completion. It displays the amount and kinds of modifications made in the projects since the proposal was written; it portrays those activities project directors describe as important for assuring success; it displays those factors which project directors describe as having been a problem for their projects; it describes project directors' attitudes toward project evaluation and recommendations they would make to NSF and to prospective project directors.

Taken together, the two broad focus techniques provide a before and after snapshot of the CAUSE program as a whole.

CHAPTER ONE

SURVEY OF CAUSE PROJECT DIRECTORS, 1976-1978

Summary of the Chapter

Kathleen Porter

This chapter describes the findings from the Survey of Project Directors. It begins by describing the purposes of the survey, its place in the overall evaluation of the CAUSE program, the development of the two versions of the survey, and the procedures used in obtaining and analyzing the survey data.

Next, general findings are summarized within five of the six issues identified as those informing the evaluation as a whole: institutional need, project implementation, instructional improvement, evaluation, and recommendations for modifications.

Specific findings are compared between those questions which are common, or at least similar, to the two versions of the survey. Tables follow which present those comparisons in terms of percentage of project directors from each of the two samples who chose each option to each question.

Survey One is then discussed in detail, item by item. Conclusions are drawn within the sections organizing the survey: project implementation questions are discussed as a unit as are project impact questions, evaluation questions and overall project success questions.

The second survey is then discussed in detail, item by item, in much the same way as the first survey. Similarly, conclusions are drawn within the sections which organize the second survey: project characteristics questions are discussed as one unit as are project implementation questions, project impact questions, evaluation questions and items concerned with recommendations.

At the end of the chapter are tables summarizing project directors' responses, first to Survey One and then to Survey Two. These tables present the percentage of project directors who chose each option to each item to both forced-choice and open-ended questions.

Development and Procedures of the Survey

This survey represents one of the broad focus data collection techniques of the evaluation of the National Science Foundation's Comprehensive Assistance to Undergraduate Science Education (CAUSE) program. The broad focus evaluation techniques, which include both the survey and the content analysis of funded proposals, provide an overview of the total CAUSE program in contrast to the site visits which provide a medium range view and the case studies which provide a close-up portrayal of some sample projects.

The survey provides reliable information on program-wide issues by aggregating the responses of virtually all the project directors on critical aspects of their projects like project implementation, impact, evaluation, and overall project success in the case of the first random sample of project directors, and project characteristics, implementation, impact, evaluation, and recommendations in the case of the second random sample of project directors.

Purpose

The function of the survey is to extend and broaden the primary data bases to include the critical insights of project directors. No other CAUSE staff participated. It is our belief that project directors have a unique perspective and can provide important information about the functioning of CAUSE projects at the local level. The purposes of the survey are to identify the diversity of views held by project directors on the critical evaluation issues and to confirm or disconfirm observations made during the 17 site visits and over the course of the eight case studies.

The specific goal of the survey is to focus on CAUSE projects in the way in which they evolve. The topics covered by the survey include how CAUSE projects get implemented, what kind of impact projects have on institutions, how decisions are made as the project progresses, and how successful projects are. These issues have been found to be important to the success of instructional improvement projects according to literature on instructional development in higher education (e.g., Diamond et al., 1975; Durzo, 1976; Holsclow, 1974).

Surveys, in general, have some very definite strengths and weaknesses. The major advantage is the ability to gather data from a representative sample by methods which are more efficient than those of direct interactions with or observation of project staff. In the case of this evaluation the representativeness of the sample is assured since the two-stage survey process surveys all funded CAUSE projects, 1976-78. Bias in sampling is one limitation of surveys which this evaluation avoids. However, another limitation of surveys--that is, the superficial level to which issues may be studied--is important to consider. By using surveying as only one method in a multiple method evaluation this study has built into it opportunities to study all issues in depth with a small number of cases. The weakness of the survey is overcome by utilization of other methods which permit more in-depth analysis.

Method of the Survey

Instrument development. The survey was developed and implemented in two stages in order to increase the validity and utility of the data and to provide an opportunity to refine the issues of the evaluation as they evolved. We sent the first survey to 50% of the project directors in the spring of 1979. At the same time some site visits and the content analyses of project proposals were conducted. The initial findings from these methods were analyzed together with the responses from the first version of the survey. All results were used to revise the survey which we sent to the remaining 50% of CAUSE project directors in the winter of 1979-80. Surveying two different samples in two stages with an initial and a revised version greatly increased the power of the resulting data.

Issue selection. The first survey was organized in accordance with the specific evaluation issues that we had identified as important. These were: 1) the extent to which high priority local college and university needs are being met by local CAUSE projects; 2) the ways in which CAUSE projects are being implemented; 3) the extent to which instructional improvement is resulting from CAUSE; 4) the nature and use of evaluation data on CAUSE projects; 5) program changes and modifications to be made in the CAUSE program. The sixth issue, the relative costs of the functional activities of CAUSE projects, we thought would not lend itself well to careful investigation in a survey. The cost analysis issue involves complex questions which must be tailored to the specific project being studied.

Based on issues which emerged from the first survey, we framed a series of questions which were to be explored in the second version of the survey. Having framed the questions, we constructed items which we hoped would meaningfully elicit responses.

The questions we believed merited exploration in the second survey are as follows:

- -Are project directors and institutions with experience in writing proposals and managing externally-funded projects more likely to write successful proposals and manage successful projects than their colleagues without previous experience?
- -Do project directors belong to a communications network through which they heard about CAUSE?
- -Is it the case that most successful proposals were submitted and re-submitted?
- -Are organizational issues (e.g., obtaining the commitment and cooperation of administrators) important to project success?
- -Is there a general confusion about what NSF means by evaluation?
- -Has there been general difficulty in the articulation between proposal and implementation especially in the areas of the management plan and the timetable?
- -Are the most important outcomes in the areas of improved faculty and/or institutional relations, student competency and improved student attitudes?
- -Are incentives provided by the institution to CAUSE project staff important to project success?

These questions could be answered only in terms of project directors' perceptions about what contributes to project success or what the most important outcomes might be.

Administration. Local CAUSE projects are extremely diverse in terms of several variables: duration of project (12, 24, or 36 months); type of institution (two-year college, baccalaureate granting college, Ph.D. granting university or a consortium); amount of NSF funding (up to $300,000); and academic discipline focus (natural, physical, social sciences or multi-disciplinary).

We believed, therefore, that it was necessary to survey the total population of project directors for three years - 1976, 1977 and 1978 (n-201). Of these, 50% were randomly selected to participate in the first version of the survey, and 50% in the revised version.

In addition to our evaluation staff, outside consultants reveiwed and critiqued both versions of the Survey of CAUSE Project Directors. The consultants represent a wide range of expertise in the following areas: science education research, instructional development and program evaluation in higher education, tests and measures development, instructional improvement projects in science, attitude scaling, technical writing, and CAUSE projects. Many helpful suggestions from the consultants were incorporated into the final version of both surveys. Several questions were dropped based on their suggestions; others were reformated or reworded.

The first version of the survey was mailed out in the spring of 1979. Eighty-nine project directors completed it.

The processes of refining the issues to be addressed in the survey and of revising the survey took place in the summer of 1979. We sent the revised survey to the second sample of project directors in the winter of 1979-80. Ninety-five project directors completed the second survey.

Data analysis. Data from the first version of the survey were coded case by case from the survey forms and put on punched cards in order to create a computer disk data file. Initial analyses included frequency, range, and variance of responses on a question by question basis. Cross tabulations of responses by question with the key CAUSE variables of length of project, type of institution, amount of funding, and academic discipline focus were made. Free responses and responses to open-ended questions were analyzed through a qualitative data reduction procedure involving the categorizing, sorting and summarizing of responses.

Data we had collected from other parts of the ongoing evaluation were combined and analyzed together with the results of the first version of the survey. These data formed the basis for determining issues to be examined in the second version of the survey.

Data from the second survey were coded and analyzed in the same manner as the first version.

Summary of Findings

The issues around which the evaluation of CAUSE has been organized are the following: (1) the extent to which high priority local college and university needs are being met by local CAUSE projects; (2) the ways in which CAUSE projects are being implemented; (3) the extent to which instructional improvement is resulting from CAUSE; (4) the nature and use of evaluation data on CAUSE projects; (5) the relative costs of the functional activities of CAUSE projects and how they relate to post-CAUSE institutional support; and (6) program changes and modifications to be made in the CAUSE program.

With the exception of the cost issue, data have been gathered in the survey on the major issues informing the CAUSE evaluation.

The results of the two surveys, taken together, are reported here for those questions which are common to both surveys or are similar enough to be discussed together. Table 1 portrays the percentage of project directors from each sample who chose each alternative to each question that was common to both surveys. The questions do not appear in full but have been shortened to statements which portray the topic of each. For a full portrayal of the percentages responding to each option, please see the tables.

In many ways the two surveys are not, strictly speaking, comparable. Some questions from the first survey were dropped for the second; some questions were added to the second survey that were not present on the first. Moreover, the first survey was meant to elicit issues and concerns from project directors which could then be investigated more fully in the second survey. However there are some questions and issues which remain the same in both surveys in order to establish response reliability. The discussion which follows is organized according to the major issues.

Institutional Need

There are a number of potential indicators of institutional need. One is whether CAUSE-related activities were initiated under other funding before the CAUSE grant was obtained and whether CAUSE activities will continue when CAUSE funding ceases. Another indicator is the level of commitment from administrators and other campus policy makers.

It may, of course, be argued that CAUSE activities can receive institutional support without necessarily reflecting institutional need: a minority of faculty or administrators may have a need which is not general for the institution. They may write a proposal and receive funding. It is unlikely, however, that the institution would continue CAUSE activities after NSF funding ended or that the majority of institutional policy makers would become committed to the CAUSE project unless there existed a general perception that CAUSE activities satisfied widespread institutional needs. Further, it is likely that an institutional history of support for CAUSE-related activities which pre-dates the CAUSE grant itself is strongly suggestive of institutional need.

We asked the second sample of project directors whether activities on the CAUSE project were begun before NSF funding was obtained. Fifty-four percent indicated that, indeed, CAUSE activities were begun before NSF funding was obtained. This is a substantial percentage and indicates that institutions were initiating activities meant to be responsive to real needs and applied for CAUSE monies to help support these activities when the institutions could not bear the financial burden alone. That NSF funds were needed is indicated by the percentage of first sample project directors (46%) who reported that without CAUSE funds they would have given up their projects.

We also asked the second sample of project directors whether they had sought or would seek additional funding when CAUSE monies ran out. Seventy percent of project directors said they would seek additional funding. Of those who said they had not or would not, virtually all of them reported that their institution would support the continuation of CAUSE activities. Strong institutional support is suggested by the fact that all project directors in the second sample believe that support will be found for the continuation of CAUSE activities except in cases where CAUSE supported "one time only" purchases like facilities construction or equipment purchase.

The commitment and cooperation of institutional policy makers seems a bit more problematical. Virtually all project directors agreed that it was an important part of the job of project director to promote good communication and good relations throughout the campus. The importance of gaining cooperation from all relevant groups on campus was stressed over and over again in different contexts. In the open-ended questions project directors cited administrative commitment and faculty acceptance as crucial to project success. They also cited these same factors as difficult to obtain. In the forced-choice questions communication problems within the institution and the reluctance of important department and school administrators to commit themselves were cited as two of the leading difficulties by both samples. Clearly, gaining the cooperation of interest groups on campus is related to the project director's role as an opinion leader and opinion maker. It is possible that project directors who cited gaining institution-wide cooperation as an issue for them originally believed rather naively that running a CAUSE project meant simply supervising implementation activities.

This would be in keeping with the finding that the vast majority of project directors agreed that "our project has cooperation from our institution's administrators at all levels" and that, "in general, our project has received cooperation from our entire academic community".

If this argument is correct, then it is probably the case that institutional policy makers generally support the CAUSE project on their campus and that the project meets some institutional needs.

Implementation

We asked project directors to describe how their projects were being implemented by asking them to respond in three areas: changes they had made from originally proposed activities; activities they believed were important to project success; difficulties they had encountered during the implementation process.

Issues concerning time and deadlines were mentioned in connection with all three areas. Timelines were most frequently mentioned as components of the project that had changed from what was described in the proposal. Delays in receiving materials and receiving approval from NSF were two of the most frequently cited difficulties. Careful planning and timely implementation were mentioned by a large majority as important to success. There has been a great deal of frustration over the inability of project staffs to meet deadlines they had set. Some contributing factors might have been: naivete of the proposal writers about how long project activities will take; NSF's schedule of approval of CAUSE proposals which is not consistent with some institutions' planning schedules; changes in project staff or in the management plan at the institutional level.

It does seem to be the case that an important element of project success is a compatible and committed project staff and that a serious difficulty, when it happens, is loss of staff or changes in staff.

Project directors noted the importance of choosing project staff carefully. They also expressed frustration over the conflicting commitments of project staff. It was felt by several project directors that staff necessarily pursue teaching, service, and scholarship activities because those are the activities which the institution is willing to reward. As a result, work on CAUSE has been an add-on. A related issue is the perception of several project directors that they have not gotten maximum productivity from their project staff.

Perhaps as important to project directors as commitment is good staff relations. Over 80% of both samples reported that working collaboratively with project staff is important to success.

A related issue, mentioned spontaneously in open-ended questions, is the role of the project director. Many project directors mentioned the enormous time and energy involved in performing the job. Apparently it is more demanding a role than many expected. The necessity of commitment and dedication was underscored.

The need for good management skills was also mentioned. The responsibilities involved in meeting deadlines, allocating responsibilities to other staff members and being the primary communication link to other parts of the institution seem to some project directors a great deal heavier than they had bargained for.

Project directors also mentioned their need for information about other projects at other institutions. Many believed that seeing other instructional improvement projects in operation could give them valuable assistance in achieving their goals and avoiding possible pitfalls.

Instructional Improvement

In both samples there are indications that project directors believe that instructional improvement has taken place. Clearly this is the most important outcome of any CAUSE project. Ultimately, any improvements brought about by CAUSE monies should benefit the student.

If the argument is credible that improving faculty guarantees instructional improvement, then two facets or components of instructional improvement are affected: student outcomes and faculty outcomes.

Although none of the questions about project impact are the same from Survey One to Survey Two, there are a few which try to elicit similar information. In fact, the questions on Survey Two are an attempt to place an increased emphasis on impact issues in light of findings from Survey One. While on Survey One, we asked two forced-choice questions, one on perceived changes in student academic performance and the other on perceived changes in the quality of instruction by faculty members, we asked four open-ended questions on Survey Two: what changes in students were expected? what changes were observed? what changes in faculty were expected? what changes were observed? Thus, the kinds of responses that could be given were considerably widened in Survey Two.

Almost 90% of Sample One project directors reported great positive change or some positive change in quality of student academic preparation. Thirty percent of Sample Two project directors spontaneously reported having observed improved student performance and competency as a result of CAUSE. Between one fifth and one quarter of project directors in both samples also reported, primarily in the open-ended questions, improved student attitudes toward science and greater student participation in decisions and activities affecting their education.

Finally, a substantial number of comments cropped up from both samples expressing enthusiasm over additional opportunities created for students. Whether the comments were in connection with questions about improved faculty performance, new or revised curricula, new facilities, equipment, or computer capabilities, or new instructional strategies, they all said the same thing: the CAUSE project has created new options and new services that can enrich the experience of the student enrolled in CAUSE-related science courses.

Project directors expressed a belief that students are benefiting from CAUSE activities in a variety of ways, some of them related to improved feelings of self-confidence and mastery when confronted with science materials.

Survey One asked project directors to rate the level of improvement in quality of instruction for CAUSE faculty members, for non-CAUSE faculty members in departments formally involved in the project and by non-CAUSE faculty in departments not formally involved with the project. Sample One project directors reported that 85% of CAUSE faculty have experienced some positive change or great positive change; 42% of non-CAUSE faculty in CAUSE departments have; and only 7% of non-CAUSE faculty in non-CAUSE departments have experienced positive change. Sample Two project directors did not make those distinctions but spontaneously reported that the leading change in faculty is that teaching effectiveness has been enhanced and faculty have a better relationship with students (22%); and the second most frequently cited change is that faculty capabilities have been broadened and increased and faculty are engaging in new activities (21%).

In this connection, it is also interesting to note that Sample One project directors reported in Question Nineteen that the most important success of their project was the growth of faculty awareness and improved attitudes and skills (28%).

It would seem, then, that whatever project directors describe their projects to be primarily about, an important outcome is faculty development. Faculty are learning how to write grant proposals, how to use the computer, how to do curriculum development and how to use new teaching strategies as a result of the CAUSE project at their institution. Project directors, reporting this in the open-ended questions in both surveys, sounded surprised and pleased by this.

Several project directors from both samples also reported, with some surprise, that faculty at their institution and particularly in departments directly affected by CAUSE were working more collaboratively than expected. Many CAUSE projects encourage the development of an esprit de corps that was not present before CAUSE.

There is also the sense that faculty morale has improved as a result of learning new skills and/or being exposed to new domains of knowledge.

Evaluation

The first sample of project directors was asked many more questions about evaluation than the second. In the first survey we asked project directors to report on the present state of their evaluation activities; what aspects of the project were being evaluated; what types of data were being collected; and who participated in decisions affecting project evaluation. We also presented a list of statements about evaluation and asked project directors to agree or disagree with them. In the second survey, there was only one item covering project evaluation: a list of statements (different from the one in Survey One) with which project directors were asked to agree or disagree.

Because of the differences in the questions between the two surveys, it is difficult to compare Sample One with Sample Two on the issue of evaluation. There is, however, detectable in both surveys, an unease about the issue. Both samples reported that the evaluation plans described in the proposal are not an accurate reflection of evaluation as it occurs. Project directors in both samples agree with statements which suggest that evaluation is valuable. Ninety-three percent of project directors in Sample One agree with this statement from Question Seventeen: "It is important that CAUSE guidelines require evaluation as part of projects." Eighty-six percent of project directors agree with this statement: "Evaluation plays a more prominent role in our project than it does elsewhere in our institution's science programs." Sample Two project directors agree in high numbers with statements like the following: "Evaluation is important to the institution in monitoring the effectiveness of projects of this type" (93%); "Evaluation results have been used to change some of the activities and/or outcomes of this project" (68%).

At the same time, a substantial minority in both samples indicated an impatience with evaluation activities as being wasteful of resources. Twenty-five percent of Sample One project directors agree that the evaluation of their CAUSE project probably requires more time and effort than it is worth; and 21% agree that formal evaluation activities take too much time and effort for their project. A large minority of Sample Two project directors agree. Twenty-seven percent agree that formal evaluation activities take up too much time, effort, and money on their

CAUSE project; and 27% agree that project funds allocated for evaluation activities could be better spent on other project activities.

There seems to be some division of feeling about evaluation in both samples. It may simply be that project directors approve of evaluation in principle and believe in its potential usefulness, but do not want to expend project resources on evaluation activities that they believe might be better used for implementation. A large minority of both samples reported that evaluation has not gone as planned, and both samples reported that they perceive evaluation as important to project success. Evaluation seems to be both a source of frustration and a vehicle for achieving desired outcomes.

Recommendations

Several questions on both surveys asked project directors if they had any recommendations to make to NSF. By far the most frequently recurring recommendation is for more information sharing. Several forums for information exchange were suggested by project directors: NSF should hold meetings, edit a newsletter or find some other means of disseminating information about various aspects of running a CAUSE project; there should be sharing of information among project directors in which mutual help is offered. More experienced project directors might offer a "lessons learned" workshop or publication.

Many project directors stated that they feel isolated. They also tend to learn the hard way how to manage a CAUSE project. There is a widespread belief that each project director should not be required to re-invent the wheel.

It is important to mention that many project directors praised NSF suggesting that NSF had always been both helpful and flexible. Comments praising NSF's cooperativeness appeared not only in response to a question soliciting recommendations to NSF in Survey Two, but appeared spontaneously in margins and at the end of the survey where extra comments were invited.

Sample Two project directors also were asked to make recommendations to prospective project directors in the areas of strategies for ensuring project success and for evaluation of project activities. These may be considered a list of lessons project directors have learned from their experience on CAUSE projects.

The three most commonly mentioned strategies for ensuring project success are: (1) making sure management and authority issues are worked out within the project staff; that is, being clear and definite about who does what, when, and who reports to whom; knowing who is doing what for the sake of effective monitoring; (2) doing careful front-end planning; trying to foresee what problems might arise and being prepared with contingency plans; and (3) getting the commitment of the faculty to the project; making sure there is widespread support for project activities.

The three most commonly mentioned recommendations concerning project evaluation are the following: (1) using outside experts to do the evaluation; these may be from outside the institution, but should at least be from outside affected departments; (2) being realistic about evaluation; not trying to accomplish more than is reasonable; finding an evaluation plan that the project director can live with and be satisfied with; and (3) doing a formative evaluation in which modifications are made as the project evolves in light of information that has been gathered.

These, then, constitute the general findings of the two surveys taken together. The following pages provide a detailed discussion of the findings from each question from each version of the survey.

Table 1

Comparison of Responses to Questions
Which Appeared on Both Survey One (S_1) and Survey Two (S_2)
Percentages of Response

Question 2a. (S_1)
Question 12a. (S_2)

Accuracy[a] of the original description in the proposal for each of the following project components.

	Accurate		Inaccurate		No Response	
	S_1	S_2	S_1	S_2	S_1	S_2
Project objectives and goals	99%	99	1	1	0	0
Project management	97	97	3	2	0	1
Timetables or time-lines	79	67	20	33	1	0
Evaluation plans	87	82	12	17	1	1
Impact of project	87	88	8	6	5	5

Question 5a. (S_1)
Question 13a. (S_2)

Importance[b] of some activities to project success.

	Important		Unimportant		Doesn't Apply or No Response	
	S_1	S_2	S_1	S_2	S_1	S_2
Project planning and management sessions	84%	82	16	14	0	2
Efforts to win support for our project at our institution	69	78	20	18	11	4
Working with faculty members on the project staff	94	83	2	13	3	4
Working with students on the project	66	70	27	22	7	8
Advising students	48	32	25	40	27	28
Writing reports and related administrative paperwork	46	39	51	59	3	2

	Important		Unimportant		Doesn't Apply or No Response	
	S_1	S_2	S_1	S_2	S_1	S_2
Ordering supplies and equipment	78	74	21	23	1	3
Evaluating the project	90	83	9	16	1	1
Designing instructional materials	92	88	4	5	3	6
Designing facilities and selecting equipment	89	84	6	9	6	8
Describing the project to others	69	69	28	28	3	2
Developing a new curriculum	61	58	20	24	19	18
Seeking financial support for the project once NSF funds are gone	63	60	30	28	6	12
Teaching related to our project	96	92	3	4	1	4
Working with lab technicians	38	56	30	21	31	25

Question 4a. (S_1)

Question 15a. (S_2)

Seriousness[c] of various difficulties which may arise on a CAUSE project.

	Serious		Not Serious		Don't Know or No Response		Doesn't Apply[d]
	S_1	S_2	S_1	S_2	S_1	S_2	S_2
Delay of formal approval of our project by NSF	8%	13	83	68	8	2	17
Confusion of responsibilities within our project	4	3	93	84	2	0	12
Insufficient attention given to project planning	5	2	91	76	3	3	19
Unclear decision making policies on our project	3	2	93	79	3	2	17
Lack of necessary technical assistance (i.e. lab assistance, materials production, A-V equipment, etc.)	7	12	89	67	4	2	19
Short supply or delay of materials	15	14	83	74	2	0	12

	Serious		Not Serious		Don't Know or No Response		Doesn't Apply
	S_1	S_2	S_1	S_2	S_1	S_2	S_2
Communication problems within our institution	11	14	87	76	2	3	7
Misunderstanding of project objectives by project personnel	2	5	96	82	2	2	11
Reluctance of important department or school administrators to commit themselves to our project	9	16	87	75	4	2	7
Lack of attention given to problems of implementation by project personnel	3	11	65	78	4	2	10
Conflicts among project personnel	6	3	91	80	3	2	15
Difficulties with our institution's rules and regulations	3	13	93	74	2	2	12
Difficulties with NSF's rules and regulations	0	0	98	81	2	2	11

S_1, N=89; S_2, N=95.

Note: Complete results for these questions appear in Tables 2 & 3.

[a] "Accurate" represents the total percentage of project directors who chose the options, generally accurate or very accurate in the original question.

"Inaccurate" represents the total percentage of project directors who chose the options, generally inaccurate or very inaccurate.

[b] "Important" represents the total percentage of project directors who chose the options, extremely important or important.

"Unimportant" represents the total percentage of project directors who chose the options, somewhat unimportant or totally unimportant.

[c] "Serious" represents the total percentage of project directors who chose the options, critically serious or serious.

"Not Serious" represents the total percentage of project directors who chose the options, somewhat serious and not serious at all.

[d] This category was used only in Survey Two.

Results of the First Survey

The results from the first survey of CAUSE project directors are reported here in detail. Each question is discussed below. Responses are shown on Table 2. Forced-choice questions are followed by the percentage of project directors who chose each alternative. These questions do not appear in full but have been shortened to statements which portray the topic of each. Open-ended questions can be identified as such because they appear in italics. Responses to these questions were analyzed for their content in order to organize categories. For open-ended questions both the percentage of the total number of project directors and the percentage of project directors who answered are reported for each response category. The first survey is organized around the following general areas of concern: project implementation, project impact, project evaluation, and overall project success.

Project Implementation

Under project implementation, we asked project directors to describe how close the project is in practice to the way it was described in the proposal. We also asked them about the level of cooperation they had received from their institution's administration and faculty members, what difficulties they had encountered that they considered serious, and what project activities they would cite as those important to project success.

Question One asked to what extent the project is meeting its original goals as stated in the proposal. Responses to Question One are overwhelmingly positive to the point where almost all (97%) project directors stated that their project has either completely or partially achieved the goals stated in the proposal. Only a few were reported to be not accomplishing at least part of their original intent.

Question Two asked project directors to describe certain project components in terms of how accurately they were described in the original proposals. The components break into three groups by accuracy of description. Project objectives and goals, project management, and budget were rated as very or generally accurate, as planned, by over 90% of the project directors. Impact of the project seems to fall somewhat lower with 86% of the project directors rating the original descriptions as accurate. Timetables or timelines and evaluation plans were rated by 77% and 85% of the directors as very or generally accurate. However, these two components were rated more frequently as generally or very inaccurate as planned by 20% and 13%, respectively, of the project directors. Of the other components none were rated by more than 7% as inaccurately described in the proposal.

On the follow-up question 2b, "How has your project been modified during its operation to incorporate new findings and/or experience gained?" 83 out of the 89 institutions replied. The most frequently cited type of modification (24%) was in the structure of the program, the way in which proposed activities were to be carried out. Most of these were changes brought about through experience and reflected a process of "getting the bugs out." Typical comments are, "The Math-Computer Resource Person has been working on a more personal or individual basis with science faculty, rather than chiefly in the form of formal presentations or lectures"; "The part of the project dealing with training social scientists to use the computer has taken a different tack, moving a bit more slowly and in smaller units than proposed"; "Project scaled down in scope, project scaled down in size to concentrate on those elements that were working better."

The second most frequently cited type of modification (19%) was a change in the equipment or construction described in the proposal. Some responses are: "Only to the extent of construction (solar heating) and construction inflation costs"; "We have acquired slightly different equipment than originally specified"; "The technology on which our project is based changes so rapidly that we are constantly faced with design changes--both hardware and software." The most frequently mentioned reasons for changes from requested equipment were inflation and changes in technology.

The third most frequently cited response, interestingly (18%), was that no modifications took place. Seventeen percent said that they revised their timetable. Many of these changes were due to initial naivete and/or slow deliveries and services. "We are approximately one year behind schedule in opening the Learning Laboratory (I think that I, as writer of the proposal, was extremely naive about time required to accomplish room renovation. However, none of the reviewers questioned my timetable, either.)"; "Timetable revised a fair amount." "Dates of purchase of equipment were moved up to beat inflation and rising costs."

Ten percent of project directors revised their budgets and 9% lost or changed project staff members. In one case a single institution experienced both types of change: "Budget revised . . . Teaching staff has been altered from that in original proposal, due primarily to change in circumstances of faculty originally designated." In most cases of budget change and staff turnover reasons were not offered, although some project directors cited inflation in connection with budget changes.

In Question Three, 91% and 99% of directors agreed that administrators and CAUSE faculty members were cooperating. In what we consider a high rate of agreement, 70% said that non-CAUSE faculty in CAUSE departments were cooperating. Fifty-one percent agreed that other science faculty were cooperating as well, while 83% said that this situation did not apply to their project. Cooperation seems to generally be forthcoming with 80% agreeing that the whole academic community was cooperative. Of course, the degree of cooperation expected from people who may be removed from the project and who are not directly responsible for project goals is likely to be less.

Seriousness of difficulties with projects is the focus of Question Four. Most of the difficulties suggested were rated as not serious--somewhat serious or not at all serious--by more than 90% of the project directors. Only five difficulties were rated as either critically serious or serious by more than 5% of the project directors. These difficulties are: delay of approval by NSF; lack of technical assistance; reluctance of administrators to commit themselves; short supply or delay of materials; and communication problems. The latter two difficulties were rated by more than 10% of project directors as serious difficulties.

Question 4b, "Are there other difficulties you have encountered in project implementation which we have not described above?" elicited a much lower response rate than the question about program modification. Sixty-three of the 89 institutions responded. There is less homogeneity of response than in the question on program modifications. However, 19% said that they had no serious difficulties to report.

The most frequently cited difficulty (12%) is that the timetable could not be adhered to. Earlier, 17% of project directors cited a change in the timetable as a modification in the program; only 5% of those did not see the change in schedule as a problem. "Delay of approach resulted in serious difficulty in employing substitute personnel, training support personnel, and the delay from ordering to receipt of equipment." "Delivery and solid operation of main computer was slow. We are just now getting good support from our vendor. It has been by the grace of our Computer Center Director's long hours that the projects have proceeded as well as they have!"

The second most often cited difficulty experienced by CAUSE project directors (11%) is too little support from the institution because either non-CAUSE faculty failed to promote the program to students, or institutional committees charged with incorporating CAUSE into the curriculum or administrators were unsympathetic. "Some problems in getting academic advisors to enroll students in experimental courses"; "Some people on campus did not seem eager to become involved unless they could...receive some funds from the project"; "Natural Science Division Chairman is a major obstacle"; "Mild interference from school administrators".

Nine percent of project directors reported that they had had to make changes in the program from the proposed sequence of events and structures. (Again, 24% of project directors reported modifications in program; apparently only 9% saw that as a difficulty.) "Some originally separate videotapes were combined, some deleted, some new ones added"; "Original ideas about the subject matter areas of curriculum materials to be developed has changed--due primarily to the energy crunch." Again, many of these changes reflect the knowledge that the program as proposed was unrealistic.

Seven percent of project directors reported that the institutional budget was inadequate for full implementation of the program: "An increase in teaching loads and decrease in institutional funds next year will make it very difficult to introduce new ideas into regular classrooms"; "Inflation and budget restrictions."

In Question Five we asked about the importance of certain activities to project success. Four activities were rated by more than 90% of project directors as extremely important or important. These activities and the percent who rated them are: working with faculty (95%); evaluating the project (90%); and teaching related to the project (95%). Seven activities were rated as somewhat or totally unimportant to project success. They were rated as such by more than 20% of the directors. These activities include: working with students on the project; advising students; ordering supplies and equipment; working with lab technicians; seeking follow on financial support; writing reports; and describing the project to others. The first four activities are ones which vary greatly across types of projects depending on project goals and design. Some projects may never require these activities to be done. The latter two activities may be ones that are just not seen as important to project success. Why follow on financial support is not rated as important by 30% of the project directors is difficult to understand. One possibility is that if the project budget is primarily geared to funding developmental costs, the project may be self-supporting on regular departmental budgets upon project completion. Another possibility is that project directors may think that follow on support is not related to immediate and direct project success, depending on the type of project.

Question 5b, "Are there other activities not identified above that are important to project success?" received only 33 responses out of a possible 89. Of those 33, 15 responded "no" or "none," leaving only 18 respondents.

Six percent of project directors mentioned the need for dedication and commitment from all participants. Underlying this is a belief that there also needs to be a feeling of teamwork and good interpersonal dynamics: "Getting ideas, activities, etc. developed by one person used by others is extremely important"; "Dedication and conscientiousness on the part of all involved--prepared for continued hard work through many revision phases (with empathy and support from program director--it has to be a success!)."

Three percent reported that institutional and/or community support is important for success. If internal dedication and cohesiveness is important, so also is the cooperation and good will of external actors: "Acceptance of the project's goals and objectives by the non-academic community"; "educating faculty." There is also a feeling expressed implicitly that project personnel must actively seek out and promote understanding of project goals among institutional members.

Three percent indicated that goal setting and project planning is instrumental to project success: "Planning in preparation of the proposal"; "An idea whose time has come--design objectives which are realistic and worthwhile." There is a sense here that good planning has to do with a realistic appraisal of what the institution is ready to receive as well as what the real needs are. This, then, is closely linked with the notion of institutional support above: trying to create "pie in the sky" represents poor planning since the institution will not lend its support to such projects.

Three percent indicated that learning ways of "making do" with their present level of funding or finding additional sources of funding is important to project success: "Seeking outside funding for project activities not funded by NSF"; "Beating inflation in order to carry our project activities with the requested NSF dollars." Although budget issues are mentioned only three times here, it will be remembered that budget problems were mentioned five times as an area of difficulty and nine institutions mentioned it as a modification.

Implications. Some problems of project implementation have been highlighted in the survey. Proposals were rated as most frequently inaccurate with respect to description of timelines and timetables. Responses to Question 2b also suggest that project schedules and management plans have been modified on a number of projects. Question Twenty also shows the problem with timelines; 13 directors were disappointed because they are behind schedule. Timeline problems appear to stem from not allowing for enough time for some or all project activities. In addition, in Question Four, delay of approval from NSF was cited as a serious problem. This problem may have occurred during the start-up year (FY76) of the CAUSE program or may be related to overlap of institution planning time and NSF timelines. It is probably also responsible for some of the timeline problems on some projects.

Another modification frequently mentioned in Question Two has been due to problems with construction, renovation, and new equipment purchases. These are problems generally beyond the project staffs' control and involve both inflated costs and, as mentioned in Question Four, short supply or delay of materials. Project directors cannot change these problems very much. However, perhaps they are too optimistic in their planning and setting of timelines when construction and equipment purchases are a critical part of a project.

Project Impact

In this section of the survey we asked project directors to describe the effects of their project on faculty and students and on the institution as a whole: how many students are being served? What is the level of involvement of different campus groups? What changes are noticeable? How innovative is the project? Have other science projects been a useful source of information?

In Question Six we report the percentages of types of students served by CAUSE projects, either science or non-science majors. Sixty-five percent of the projects serve science majors and 55% serve non-majors. Since a project may serve one group exclusively or may serve both simultaneously, the percentages reflect some overlap of projects.

In Question Seven we asked project directors about the extent of the involvement of different groups in their projects. Not surprisingly, 100% of the directors rated CAUSE faculty members as having some or extensive involvement. Eighty percent of the projects involve students extensively or in some degree. Other faculty in a CAUSE department are involved as well. Eighty-three percent of the projects have minor or no involvement of faculty from non-CAUSE departments. As in Question Three on cooperation, faculty in non-CAUSE departments should be expected to be less involved than those in closer proximity and with more responsibility to the project.

Funding alternatives to CAUSE is the topic of Question Eight. A sizable percentage (46%) of directors responded that they would have given up the project for lack of funds. The 23% who cited "Other" generally listed two of the given alternatives as equally possible. The difficulty with this question is that it only describes an inclination to act. It cannot describe what really does happen when CAUSE funds are not available.

Question Nine focuses on changes that might be related to CAUSE project activities. Eighty-seven percent of the project directors responded that at least some positive change in quality of students' academic preparation could be attributed to their project. Eighty-five percent thought the quality of CAUSE faculty members' instruction had changed positively. Some directors (42%) attributed positive change in the quality of non-CAUSE faculty members' instruction in CAUSE departments. Thirty-seven percent said there was no change while 19% did not respond. Seventy-one percent saw no change in the quality of instruction by faculty members in departments not formally involved in the project. Twenty-three percent did not respond. One would hope that the quality of instruction has improved due to CAUSE. It is surprising that as many as 42% of the respondents thought that non-CAUSE faculty members in involved departments were also affected. That tends to support the CAUSE program objectives which aim to improve institutional capabilities in self-assessment and to improve undergraduate science instruction. It is also interesting to note how many directors were willing to respond to this question, although it is a very difficult one to answer.

In Question Ten we asked project directors about their opinions on how innovative their projects are. Most (72% or more) rated their projects as, at least, somewhat innovative at the department, institution, and national level. However, 21% were not sure about project innovativeness in comparison to science education nationally. Instructional innovation is not a CAUSE program goal and, therefore, no great importance can or should be attached to this question. Instructional innovation and instructional improvements do frequently occur together, however.

Question 10b, "Please identify briefly the most innovative aspect of your project," received 86 responses out of a possible 89.

The most frequently cited component of the program (34%) was the creation and implementation of unique courses or aspects of courses. There runs through these comments a genuine air of excitement and discovery: "Designing a curriculum based on the reasoning patterns of students--using the content of the sciences to teach these thinking skills"; "Our use of graphics equipment to enhance mathematics teaching in the low-level courses"; "New approach to cross-disciplinary problem solving in science and the implementation of science and engineering materials in a liberal arts college."

The second most frequently mentioned innovation (19%) was the introduction of some aspect of computer use. Some of these might have fit within the category of unique courses above but since they are both numerous and cover a wide spectrum of kinds of uses, they are given their own category.

The comments in this category reflect a belief that computer use is crucial to undergraduate science education: "This project opened up the entire field of academic use of computers on our campus. It is hard to imagine where our mathematics, physical science and some social sciences instructors would be today without this project"; "Retraining of faculty in math to teach computer related courses and total revision of mathematics, computers and statistics degree offerings"; "Our project has introduced a computer science program where there had been none."

Eleven percent of project directors reported that new roles and relationships among faculty members was the most innovative aspect of the program. Most of those reporting said that faculty working together for a common goal was innovative; some said that faculty relationships with students had changed in that faculty had gained the freedom to work more flexibly with students to meet their needs: "We bring together faculty from six similar colleges to work on mutually beneficial tasks"; "Instructors are released from repetitious activities to pursue individual student needs"; "Interdisciplinary team-teaching among science faculty."

Ten percent of project directors reported that the involvement of students in various aspects of the program was the most innovative part of their project. This reflects the strong concern about and commitment to a student-oriented curriculum that is a theme throughout these comments: "Student involvement in project evaluation as another form of research activity"; "The emphasis on an investigative approach in the laboratory which requires students to design, conduct, and interpret experiments in an attempt to move students from the concrete level of the Piagetian system."

In Question Eleven, more than half of the project directors indicated that other projects had been a useful source of information. When available and aware of them, project directors do appear to use ideas from other institutions.

Question 11b, "If they [science projects similar to yours at other institutions] have been [a useful source of information and ideas], how did you learn about them?" elicited 56 responses. Those who responded to the question said that they had learned of other science projects through journals, books, directories and professional meetings (27%): "From journal articles and attending conferences"; "Reading about their activities in journals and science literature."

Eighteen percent of project directors reported that they had gathered information through word of mouth and personal contacts: "Primarily through faculty contacts"; "Through faculty members with personal contacts." These first two categories tend to overlap somewhat; that is, those faculty who attend meetings to learn about innovations also tend to report personal contacts as a major way of gathering information.

The next most commonly reported mechanism for gathering information on innovations was the CAUSE project directors' meeting in Washington, D.C., and/or other CAUSE-sponsored meetings. This would suggest that those meetings are functional in that they give project directors an opportunity to share ideas: "Through CAUSE project directors' meeting in Washington, D.C.";"At the CCUC/9 (CAUSE meeting) in Denver, Colorado."

Finally, 7% of project directors reported that copies of CAUSE proposals had been useful sources of information about other science projects: "After seeing titles of CAUSE projects in NSF lists we have obtained copies of appropriate proposals." Again: NSF is being used by project directors as a source of information, and one of its roles vis a vis CAUSE is as a dissemination center.

Question 11c says "If they [science projects similar to yours at other institutions] have not been [a useful source of information and ideas], why were they not useful?" Twenty-four institutions responded. Eighteen percent of the total number of project directors responded that they had not identified a program that was sufficiently similar to be useful: "None of a similar nature known to us"; "The CAUSE project at Another university is the only one with objectives closely related to ours. I did not find any components of that program that would be useful additions or changes for our project."

The only other reason offered (9% of project directors) was that knowledge was not available. It is not always clear from the responses why program planners lacked knowledge. In one case it is blamed on the institution: "Staff development and sharing of project ideas is a low priority in our institution and especially among faculty members." In most instances, though, the lack of knowledge is simply stated as a fact, though when stated in the passive voice, "Not made available" the implication, clearly, is that someone who should have enlightened the project director did not. Other times the lack of knowledge is attributed to a lack of need for knowledge: "Not needed for our development"; "I have not sought a great deal of assistance."

Implications. Questions Seven and Nine suggest frequent cooperation and involvement of non-CAUSE faculty members in departments which are part of CAUSE project activities. This involvement is higher than might be expected given conventional wisdom about higher education department politics. It is important to examine and more fully describe this involvement in other data collection activities because it may be an important impact of CAUSE projects. The fact that bringing faculty together was frequently cited as the most innovative aspect of projects suggests that this involvement may be real and not just a "halo effect" of having a CAUSE project.

It had been thought that institutional administrators shy away from lending support to instructional improvement projects. Question Three indicates that cooperation is forthcoming from administrators according to many project directors. In Question Four however, some directors said that lack of commitment from administrators was a problem. So it appears that institutional support is problematical and is explored further in the site visit and case study reports.

There are mixed results as to whether CAUSE project staff are a source of problems on projects or not. Questions Three and Seven show extremely high cooperation and involvement of project staff in the projects. In Questions Two and Four staff changes and modifications were noted as difficulties by some projects. In Question Five, commitment and dedication of staff is given as important to project success, and in Question Twenty failure to get maximum productivity is given as the most frequent significant disappointment on projects. These questions do not focus on exactly the same aspects of staffing, but project directors' descriptions of commitment do vary.

Project outcomes are specifically cited in open-ended questions as the most innovative aspect of the project and the most important project success. Curriculum development and expansion in Question Twenty might be seen as the source of the unique courses or aspects of courses noted as innovative in Question Ten. Computer use and new facilities including computers were very frequently listed as the innovative and most successful aspect of projects. Improved and new skills for faculty were also specifically mentioned as the important success for many projects.

With all the focus on new equipment, new computers, curriculum development, and improved faculty skills one wonders at times if the utlimate objective of all of these activities gets forgotten. In the end, quality of instruction should lead to students' gains. Questions Nine and Nineteen suggest that many project directors believe that instruction has improved, and that has led to improvement in student attitudes and performance. Of course, positive gains in learning are most elusive when it comes to validating or even verifying them. Evidence of instructional improvement is also examined in the second survey.

Project Evaluation

This section takes up the issue of project evaluation: What are project directors doing in the way of evaluation? What aspects of projects are being evaluated? Who participates in decisions affecting evaluation? What attitudes do project directors hold toward evaluation?

As seen in Question Twelve, 85% of the directors noted that they are already collecting evaluation data on their projects. Twenty-six percent noted that evaluation planning is underway, and 71% said that evaluation activities are ongoing. Only 2% indicated that they had not begun to consider evaluation. These responses represent a high level of participation in some form of evaluation activities, including data collection.

Questions Thirteen, Fourteen, and Fifteen indicate aspects of projects being evaluated and types of data being collected. We asked project directors to check all alternatives applicable to their projects. There are sizable percentages for almost all the project aspects and types of data. The most frequently checked aspects of projects to be evaluated are student reactions to the project, student performance, and instructional materials. Most frequently cited types of data include examinations, course grades, faculty and student opinions, and documentation of project activities. The difficulty with the responses to these questions resides in the way in which alternatives for evaluation are handled. The aspects of the project evaluated and the types of data collected may be studied with extensive and formal procedures or they may be studied through informal and intuitive processes.

In Question Sixteen we asked project directors about the participants in evaluation decision-making. Most indicated that all project staff are involved but this does not show up in the tabulated results. Most of the 29% who indicated "Other" described some combination of all project staff and consultants, evaluation staff, or project directors. There appears to be cross-project involvement of staff in evaluation decisions.

Finally, Question Seventeen attempts to explore some opinions project directors may have about evaluation. Evaluation is heavily endorsed by CAUSE guidelines as is illustrated by the program objective, . . . to enhance the capability of the institutions for self-assessment, management, and evaluation of their science programs. Eighty-six percent of the project directors agreed that their project evaluation has a more prominent role than it has elsewhere in their institution. There is heavy support for evaluation to be required in the guidelines, with which 93% of the project directors agreed or strongly agreed. There is some indication that evaluation takes more effort than it is worth and requires too much time, according to 25% and 21% of the project directors. Almost one-third (32%) indicated that evaluation would not be included in their project if it had not been required. Many respondents were favorable disposed toward evaluation but there is a minority who question its worth.

Question Eighteen asks, "If there are any formal or informal evaluation activities on your project which have not appeared in the above items, please describe these activities below." Sixteen institutions responded. Nine percent mentioned meetings with project staff, surveys and other attempts at "debugging" the project. These were all attempts at formative evaluation to improve the project as it got underway: "In periodic meetings with project faculty--there was feedback on what needed to be changed--what is working--also there has been monthly monitoring of project faculty's progress on the project"; "Math-Science Division full-time instructors have met and evaluated much of the total division of activities due to the CAUSE project."

The use of outside consultants to conduct evaluation activities was mentioned by 3%: "Graduate intern from nearby university is major evaluation consultant"; "We have an annual visit by three faculty from other schools. This group of outside evaluators have been sensational."

Finally, 3% of project directors emphasized the student role in the evaluation effort: "Students (and faculty) have evaluated every program in the IMC"; "We have involved students directly in the evaluation effort." Again, this seems to reflect the strong interest displayed throughout these questions in impacts on students and on student involvement.

Implications. The picture of project evaluation as it emerges from Questions Eleven and Seventeen is one of extensive activities. Yet in Question Two evaluation plans were cited as frequently inaccurate as described in the original proposals. If project evaluation is so extensive, how and why were the original plans inaccurate? Another indication of unclear trends in project evaluation may be seen in Question Seventeen where evaluation is rated as important and should be required, yet a sizeable minority express doubt about the time and effort it takes. Also from Question Seventeen one gets the image of increased expertise on the part of individual faculty members but not necessarily of increased expertise at the department or institutional level as is the third goal of the CAUSE program.

Overall Project Success

In this section we asked project directors to cite their most important success, their most significant failure and any aspects of the CAUSE program that they thought merited additional study.

In Question Nineteen we asked, "What has been the most important success your project has experienced?" This question elicited 86 responses. Twenty-eight percent of project directors indicated that the growth in faculty awareness and/or the acquisition of new skills by faculty has been the most important success. Just the sense of growth and learning among faculty, in other words, has created a very positive atmosphere, one which clearly excites project directors: "Increasing awareness of and interest in instructional innovations and evaluation of instructional approaches"; "At this point in the project an awakening and broadening of the department members"; "Revitalization of the faculty."

Twenty-six percent of project directors reported that the process of curriculum development, the expansion and revitalization of course offerings, has been the most important success of their project: "We have a significant use of computation in the Social Science Classes"; "Curriculum development--absolutely crucial for improvement of our science education"; "Development of integrated, interdisciplinary and process oriented science course for non-science majors." Again, running through these comments is a sense of enthusiasm and excitement.

Twenty percent of project directors reported that the acquisition of new facilities, lab equipment, or computer equipment has been the most important success their project experienced. This reflects both the fact that many CAUSE projects were primarily aimed at improvement of equipment and facilities and the wide-spread conviction among science educators in these institutions that good undergraduate science education is dependent upon modern laboratory facilities and/or computer capabilities. "This has permitted us to develop a $700,000 elegant new laboratory with our NSF-funded Computer Assisted Laboratory integrated fully into it. We believe we now have one of the best, up-to-date teaching science laboratories in the country!"; "Getting a learning center into operation"; "The fact that a cross-discipline modularized science laboratory is in full-scale operation now in contrast to no science laboratory of any kind at the beginning of the project."

Sixteen percent of project directors reported that their project's greatest success was in the improvement of students' attitudes toward science courses and/or in student performance. "Better student study habits, greater understanding of course material"; "Enthusiastic response of students to the field experience they have participated in." The majority of these responses emphasize student attitude, and, in this sense, they are similar to the comments made about faculty; that is, there is communicated an appreciation of the affective outcomes of the project rather than simply the cognitive.

This is explicitly stated by 11% of project directors who comment that, in their view, the project's greatest success has been to create a new sense of community or a new institutional purpose. These respondents are most impressed by the team spirit or the new cooperation engendered by the project: "Formation of a closely knit teaching team that has worked endlessly to develop an integrated science curriculum"; "General acceptance of the project's goals by the entire college community and active involvement of a large segment of the academic community"; "Getting people to work together in program development."

Question Twenty, "What has been the most significant disappointment or failure your project has experienced?" received 81 responses out of a possible 89. The majority of project directors found non-human factors to be the most frustrating: if the categories having to do with funding level, timetables, project goals, etc. are added together, they slightly outweigh the categories having to do with human factors like support, cooperation, staff productivity (39 to 38).

Sixteen percent of project directors report an inability to get full productivity from project staff. Sometimes this reflects an impatience with the staff members themselves, but most often it is reflective of frustration with the lack of time and resources available to staff members: "It has been difficult for the project to compete with other more immediate demands for the time of staff"; "Increased pressure on faculty time"; "Partial faculty release time not equal to adequate quality time/effort devoted to project."

Fifteen percent of project directors responded that being behind schedule was the most disappointing aspect of their program: "We are behind our original time schedule"; "The length of time necessary to develop a refined individualized laboratory module was considerably greater than originally anticipated." The issue of schedule has been raised before; problems with scheduling arise mainly from unrealistic expectations, delayed deliveries and changes in staffing.

Fifteen percent of project directors reported lack of institutional support as their greatest disappointment. The great importance of non-CAUSE faculty/administration acceptance of the innovation has been emphasized throughout the open-ended questions and is implied in those comments emphasizing community, cooperation and sharing of ideas. Typical comments: "Not involving the entire math and science faculty and therefore, not receiving the enthusiastic support we needed"; "Lack of interest on part of mathematics faculty and a few computer science teachers."

Question Twenty-one, "Please list any particular aspects of the CAUSE program that you believe merit additional study" received 45 responses from institutions. Unlike some open-ended questions, this evoked a wide range of responses; it has been necessary, therefore, to limit discussion only to those issues mentioned by at least three institutions.

Nine percent of project directors expressed an interest in studying and reporting on the successes and failures of CAUSE programs for purposes of learning what works and what does not work in introducing educational innovation: "Determine where and how global components of CAUSE projects succeeded or failed"; ". . . I would hope we could, as a group, pass along the lessons we have learned, either through a summary of all CAUSE projects or by forming a pool of former project directors, available for consultation"; "Ways in which the varied experiences . . . of CAUSE recipients can be made known"; "We need to know about successes and failures of other projects as soon as possible in order to change the approaches." These comments express a real need to know what is going on in other projects that can help the harried project director.

Seven percent of project directors were interested in studying the feasibility of expanding CAUSE innovations to new groups of students, to new departments and even to new fields (e.g., the humanities): "The desirability of program extension . . . to continue providing services to our students and community"; "teaching of basic scientific principles to the non-scientific as the tools for comprehending complex issues facing the world"; "Transfer this design of curriculum to social sciences and humanities."

Six percent of project directors indicated an interest in studying learning outcomes using their particular innovations. Some of these advocated classical experimental designs: "Problem: the apparent improvements in student achievement the result of innovative instructional approaches or the renewed enthusiasm of instructors"; "A strictly controlled study to determine the efficacy of computer assisted instruction."

A concern very strongly expressed by 6% of project directors was in the area of project evaluation. There is a strong sense of confusion, frustration and, perhaps, anger at what is perceived as haziness and lack of clarity from NSF on the guidelines for evaluation. ". . . better guidelines on evaluation. Many project directors I spoke with considered the evaluation to be almost meaningless and it shouldn't be!"; "I believe most CAUSE directors really don't understand what NSF wants re revaluation. Most of the people I talked with at a recent project directors' meeting thought the evaluation instructions/directions were 'phony' and only present to please Congress."

Implications. These findings are at best suggestive. But taken together with other data, they can help validate other findings. If other data suggest, for example, that changes in faculty attitudes and skills are indeed more significant than other changes connected with the CAUSE project, that is an important finding.

Table 2

Survey of CAUSE Project Directors
Percentages of Response
Spring, 1979
N = 89

1. Extent to which project is meeting or will meet its original goals as stated in the proposal.

Completely Achieved	Partially Achieved	Only Slightly Achieved	Not Achieved At All	No Response
57%	40	1	0	1

2a. Accuracy of the original description in the proposal for each of the following project components.

	Very Accurate	Generally Accurate	Generally Inaccurate	Very Inaccurate	No Response
Project objectives and goals	62%	36	1	0	0
Project management	41	54	2	1	0
Timetables or timelines	6	71	17	3	1
Budget	20	73	4	1	0
Evaluation plans	15	70	12	1	0
Impact of project	33	53	6	1	5

Note: Percentages may not add up to 100% due to rounding error or because project directors were free to give more than one response. Questions which appear in italic type had open-ended responses which were then categorized. For these questions percentages are shown for both the total number of survey respondents and the number of respondents to the question.

2b. *How has your project been modified during its operation to incorporate new findings and/or experience gained?*

% of Total	% of Respondents	
24	25	Proposed activities/management plan
19	21	Construction/equipment
18	19	No changes
17	18	Schedule/timetable
10	11	Budget
9	10	Project staff
6	6	Different courses
6	6	Evaluation
4	5	Goals/objectives
4	5	Materials acquisition
1	1	Reward structures for participation

3. Cooperation received from the institution's administration and faculty members.

	Strongly Agree	Agree	Disagree	Strongly Disagree	Doesn't Apply or No Response
Our project has cooperation from our institution's administrators at all levels	60%	31	4	2	2
Our project has cooperation from all faculty members who are part of the CAUSE project staff	69	30	0	0	1
Our project has cooperation from all non-CAUSE faculty members who are in CAUSE project department(s)	25	45	15	1	14
Our project has cooperation from all non-CAUSE science faculty members in non-CAUSE departments	16	35	10	0	39
In general, our project has received cooperation from our entire academic community	33	47	7	2	11

4a. Seriousness of various difficulties which may arise on a CAUSE project.

	Critically Serious	Serious	Somewhat Serious	Not At All Serious	Doesn't Apply or No Response
Delay of formal approval of our project by NSF	1%	7	18	65	8
Confusion of responsibilities within our project	1	3	12	81	2
Insufficient attention given to project planning	2	3	18	73	3
Unclear decision making policies on our project	2	1	12	81	3
Lack of necessary technical assistance (i.e., lab assistance, materials production, A-V equipment, etc.)	2	4	16	73	4
Short supply or delay of materials	1	13	34	49	2
Communication problems within our institution	2	9	26	61	2
Misunderstanding of project objectives by project personnel	1	1	18	78	2
Reluctance of important department or school administrators to commit themselves to our project	3	6	20	66	4
Lack of attention given to problems of implementation by project personnel	0	3	29	63	4
Conflicts among project personnel	1	4	12	79	3
Difficulties with our institution's rules and regulations	3	1	22	71	2
Difficulties with NSF's rules and regulations	0	0	3	94	2

4b. *Are there other difficulties you have encountered in project implementation which we have not described above?*

% of Total	% of Respondents	
19	27	No, nothing serious
12	18	Timetable could not be adhered to
11	16	Too little support from institution
9	13	Changes in program from proposal
7	10	Institutional budget inadequate for full implementation
4	6	Loss/changes in staff
3	5	Problems in promoting program to students
3	5	Project staff had too little time/energy
2	3	Too much responsibility of director
2	3	Problems with non-NSF state/federal agencies
2	3	Poor communication with NSF
2	3	Difficulty in management of project
2	3	Evaluation

5a. Importance of some activities to project success.

	Extremely Important	Important	Somewhat Unimportant	Totally Unimportant	Doesn't Apply or No Response
Project planning and management sessions	45%	39	16	0	0
Efforts to win support for our project at our institution	35	34	13	7	11
Working with faculty members on the project staff	53	42	2	0	3
Working with students on the project	27	39	25	2	7
Advising students	17	31	19	6	27
Writing reports and related administrative paperwork	3	43	44	7	3

	Extremely Important	Important	Somewhat Unimportant	Totally Unimportant	Doesn't Apply or No Response
Ordering supplies and equipment	39%	38	19	2	1
Evaluating the project	27	63	9	0	1
Designing instructional materials	61	31	4	0	3
Designing facilities and selecting equipment	58	30	6	0	6
Describing the project to others	17	52	28	0	3
Developing a new curriculum	36	25	15	4	20
Seeking financial support for the project once NSF funds are gone	26	37	22	8	6
Teaching (related to our project)	58	37	3	0	1
Working with lab technicians	18	20	21	9	31

5b. *Are there other activities not identified above that are important to project success?*

% of Total	% of Respondents	
6	15	Dedication/commitment of all involved
3	9	Institutional/community support
3	9	Good planning/goal setting
3	9	Getting extra funding or finding ways to make do with present level
2	6	Good job of hiring staff
2	6	Interpersonal dynamics
2	6	Mechanics of producing materials/student use of materials
2	6	Evaluation
1	3	Reviewing instructional materials

6. Percentages of students served by CAUSE projects who are science majors or non-science majors.

	Science Majors		Non-science Majors	
% of students	# of projects	% of projects	# of projects	% of projects
0	31	35	40	45
1-9	6	7	10	11
10-19	4	5	5	6
20-29	9	10	8	9
30-39	4	5	2	2
40-49	3	3	4	5
50-59	2	2	4	5
60-69	1	1	1	1
70-79	4	5	3	3
80-89	6	7	3	3
90-99	9	10	5	6
100	10	11	4	5
Total	89	101	89	101

7. Extent of involvement of different groups in CAUSE projects.

	Extensive Involvement	Some Involvement	Minor Involvement	No Involvement	No Response
Institution administrators	7%	38	46	8	1
Department heads	25	39	27	8	1
Faculty members on the CAUSE project staff	93	7	0	0	0
Faculty members in CAUSE department(s)	38	40	17	3	1
Faculty members in non-CAUSE departments	1	15	45	38	1
Students	44	36	13	3	3
Evaluation experts	17	51	24	9	0
Media specialists	13	19	24	43	1
Lab technicians	22	16	16	45	1
NSF staff	1	15	52	33	0

8. Funding alternatives which might have been taken if CAUSE funds had not been available.

13%	Sought other federal funding
2	Sought state funding
9	Sought private funding
3	Sought additional resources elsewhere within our institution
3	Undertaken the project on department(s)'s existing budget
46	Given up on the project for lack of funds
23	Other

9. Direction of changes which might be related to CAUSE project activities.

	Great Positive Change	Some Positive Change	No Change	Some Negative Change	Great Negative Change	No Response
Quality of academic preparation of students attributable to our CAUSE project	24%	63	2	1	0	9
Quality of instruction by CAUSE faculty members	19	66	6	0	0	9
Quality of instruction by non-CAUSE faculty members in departments formally involved with our project	7	35	37	0	0	19
Quality of instruction by non-CAUSE faculty members in departments not formally involved with our project	0	7	71	0	0	23

10. Innovativeness of CAUSE projects as compared to:

	Very Innovative	Somewhat Innovative	Not Innovative	Not Sure	No Response
Regular activities of the department(s) involved in CAUSE	52%	42	2	5	0
Other science departments	43	38	3	5	11
Science departments nationally	24	48	6	21	1

10b. *Please identify briefly the most innovative aspect of your project*.

% of Total	% of Respondents	
34	35	Unique courses or aspects of courses
19	20	Computer use
11	12	Bringing together faculty to work together/ freeing up faculty for students
10	11	Involvement of students in aspects of the project
9	9	Individualized instruction
8	8	Changes in majors and/or sequences of courses
6	6	Evaluation of program
2	2	Equipment and laboratories
2	2	Use of institutional personnel other than faculty
1	1	Relationship with outside agencies
1	1	Introduction of media center

11a. Have science projects (either CAUSE or non-CAUSE) similar to yours at other institutions been a useful source of information and ideas?

57% Yes 30 No 12 Don't know

11b. *If they have been, how did you learn about them?*

% of Total	% of Respondents	
27	42	Journals, meetings, books, directories
18	29	Word of mouth/personal contacts
18	29	CAUSE directors' meeting in Washington, D.C. and/or other NSF meetings
11	18	Visits to other campuses and/or correspondence
7	11	Copies of CAUSE proposals
2	4	CONDUIT
1	2	Chautauqua short courses
1	2	Consultants
1	2	Staff members, ex-NSF readers

11c. *If they have not been, why were they not useful?*

% of Total	% of Respondents	
18	67	Haven't identified any programs sufficiently similar
9	33	Knowledge of other programs has not been needed and/or made available

12a. Current status of project evaluation activities.

2%	We have not yet begun to consider evaluation activities.
7	We have begun evaluation planning but have made little progress.
18	We have begun evaluation planning and have made modest progress.
1	Evaluation planning is nearly complete.
0	Evaluation planning is complete.
71	Evaluation activities are going on now on our project.
1	Evaluation will probably not be a part of this project.

12b. Evaluation data are being collected on a regular basis already.

85% Yes 10 No 3 No response

13. Aspects of the project to be evaluated. (Projects may be collecting data on more than one.)

89%	Student reactions to project
78	Student performance
52	Classroom and teaching processes
43	Faculty performance
80	Instructional materials
55	Courses or curriculum
72	Project activities as a whole
10	Others

14. Measures of student achievement which are part of project evaluation. (Projects may be collecting data on more than one.)

51%	Multiple-choice or essay examinations
17	Papers or essays
35	Experiment or laboratory reports
26	Grading of in-class performance
40	Overall course grades
15	Special project grades
29	Proficiency tests of special skills or special training
13	Presentations
6	None
17	Others

15. Other types of evaluation data. (Projects may be collecting more than one.)

71%	Faculty opinions or ratings of project activities or outcomes
82	Student opinions or ratings of project activities or outcomes
34	Observations of students in class
27	Observations of faculty teaching
80	Documentation of project activities
49	Interviews with project participants
26	Attrition reports
42	Enrollment records
0	None
12	Other

16. Participants in major decisions on project evaluation.

16%	The project director
6	A single person responsible for conducting the evaluation (other than the project director)
9	A small group of project staff (other than the above)
40	All or most of project staff
0	Non-CAUSE faculty members
0	Non-CAUSE administrative personnel
29	Other

17. The role of project evaluation.

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Response
Evaluation plays a more prominent role in our CAUSE project than it does elsewhere in our institution's science programs	44%	42	15	0	0
The evaluation of our CAUSE project probably requires more time and effort than it is worth	6	19	62	13	0
It is important that CAUSE guidelines require evaluation as part of projects	33	60	6	2	0
Project staff have acquired additional expertise in evaluation as a result of the CAUSE project	24	49	20	2	5
If CAUSE guidelines had not required evaluation it would not have been included in this project	12	20	53	15	0
Our CAUSE project has helped science faculty members to integrate evaluation into ongoing science programs at our institution	10	33	45	7	6

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Response
Formal evaluation activities take too much time and effort for our project	5%	16	62	17	1
Our CAUSE project has led to an increased concern for the quality of evaluation efforts in my department	8	40	44	3	5

18. *If there are any formal or informal evaluation activities on your project which have not appeared in the above items, please describe these activities below.*

% of Total	% of Respondents	
9	50	Formative evaluation involving faculty feedback
3	19	Students involved with evaluation effort
3	19	Use of outside consultants
1	6	Pre-test, post-test on student achievement
1	6	In future, evaluate alternative modes of A.V. presentation

19. *What has been the most important success your project has experienced?*

% of Total	% of Respondents	
28	29	Faculty awareness, improved attitudes, new skills
26	27	Curriculum development/expansion
20	21	New facilities/computer
17	17	Improvement in student attitudes/performance
11	12	New sense of community/purpose
8	8	Development of new instructional methods
3	3	Development of individualized instruction
2	2	Generation of evaluation scheme
2	2	Outreach to other institutions or departments or industries that are in the forefront of science and science teaching

20. *What has been the most significant disappointment or failure your project has experienced?*

% of Total	% of Respondents	
16	17	Failure to get maximum productivity from staff
15	16	Behind schedule
15	16	Lack of institutional support
9	10	Insufficient funding
8	9	No disappointments yet
8	9	Difficulty in gaining student support
7	7	Some project goals not met
6	6	Integration of innovation into curriculum
6	6	Equipment problems
2	3	Evaluation
2	3	Lack of skilled programming
2	3	Loss/change of staff

21. *Please list any particular aspects of the CAUSE program that you believe merit additional study.*

% of Total	% of Respondents	
9	18	Study successes/failures--do a "lessons learned" dissemination effort
7	13	Desirability to expand project to new populations/departments/fields
6	11	Do a study on effectiveness of one pedagogic innovation over another or over regular program
6	11	Find a way to do better evaluations
3	7	Look for better management strategies for project

Results of the Second Survey

The results from the second survey of CAUSE project directors are reported here in detail. Each question is discussed below. Responses are shown on Table 3. Forced-choice questions are followed by the percentage of project directors who chose each alternative. These questions do not appear in full but have been shortened to statements which portray the topic of each. Open-ended questions can be identified as such because they appear in italics. Responses to these questions were analyzed for their content in order to organize categories. For open-ended questions both the percentage of the total number of project directors and the percentage of project directors who answered are reported for each response category. The second survey is organized around the following general areas of concern: project characteristics, project implementation, project impact, project evaluation, and recommendations.

Project Characteristics

Under Project Characteristics, we asked project directors to tell us what the key outcomes have been, what the history of project activities similar to CAUSE has been at their institutions, how the proposal was developed and who participated, and what experience project directors and project staff had had in research projects or instructional improvement projects prior to CAUSE. We were interested in investigating the following questions:

- -Are project directors and institutions with experience more likely to write successful proposals?
- -Is there a communications network among science educators? Do most project directors belong to that network and hear about CAUSE because of their membership?
- -Is it possible that most successful proposals were submitted and resubmitted?

In Question One, we asked project directors to identify the three most important project outcomes. The three most commonly mentioned outcomes were: curriculum additions/revisions (81% of project directors included it); equipment and facilities acquisition (59% of project directors included it); and individualized instruction (54% of project directors included it). Clearly, whatever else a project included, it also tended to include curriculum additions and revisions. Surprisingly, computer applications was not among the top three. We also asked project directors to choose the one outcome which best describes their project. Eighty-seven project directors responded to this item. Although the question asks project directors to choose one outcome as that which best describes their project, this is obviously difficult for several. Some of them listed more than one outcome; other specifically stated that they could not choose one as much more important. Thus, the categories do not reflect each project director's one top choice. The categories reflect the number of times an outcome is mentioned by a project director.

Twenty-eight percent of project directors chose "curriculum additions and/or revisions". While most project directors listed this by itself, a few underscored the fact that, for them, outcomes cannot be easily separated: "Curriculum revisions--but to say so is misleading. Our project is balanced and carefully integrates the four categories"; "Curriculum additions with emphasis on new instructional strategies plus lab field experience."

Twenty-three percent of project directors listed "equipment and facilities acquisition". Again, frequently this is in connection with another outcome or outcomes, although it is most often listed by itself. Typical of mixed responses are these: "Individual instruction (but made possible by equipment acquisition)"; "Equipment and facilities acquisition and computer applications."

Seventeen percent of project directors chose "computer acquisition/application". This is frequently listed as a single item, but is also combined with other outcomes: "Developed computer-based lessons for individualized instruction"; "Really best description is a combination of 'curriculum additions' and 'computer applications'."

Sixteen percent of project directors listed "individualized instruction" as their major outcome. This is seen sometimes as involving "curriculum additions and revisions"; sometimes "equipment and facilities acquisition", and sometimes "computer applications". Most frequently it is listed by itself. Typical of responses is this one: "Developed computer-based lessons for individualized instruction."

In Question Two we asked project directors whether their CAUSE project was an extension of instructional improvement activities begun before CAUSE funding. Fifty-four percent of project directors reported that some of the activities on their CAUSE project were begun either under support from another externally-funded project at their institution (10%) or on funds from their institutional budget (44%). Thirty-four percent of project directors reported that no project activities were begun before CAUSE funding.

In Question Three, we asked project directors whether their institution had submitted a proposal to CAUSE before this one was funded. Thirty-eight percent of project directors reported that another version of the current proposal had been submitted, while 22% reported that a proposal for another project in the same discipline (5%) or in another discipline (17%) had been submitted. Altogether 60% of project directors reported that the proposal for their current project was the only one ever submitted to CAUSE. Twelve percent reported that no other proposal was submitted to their knowledge.

In Question Four we asked whether project directors had requested and received reviewer's comments from NSF if their institution submitted a proposal that was not funded. Forty-five percent reported that they had requested and received reviewers' comments. Forty-eight percent reported that they had requested reviewers' comments but never received them. Six percent reported that reviewers' comments had not been requested to their knowledge. We also asked how reviewers' comments were used. Sixty-nine project directors responded to this item.

Twenty-four percent of project directors reported that they used reviewers' comments on an earlier version of their funded proposal to make needed modifications and to rectify deficiencies. These project directors did not specify what modifications they made. Typical of responses are these: "Others [comments] were addressed by rectifying deficiencies in the earlier proposal"; "Correct deficiencies cited by reviewers and re-submitted"; "We looked carefully at the weaknesses cited by reviewers and made adjustments to correct them."

Twenty-three percent of project directors reported that the item does not apply to them (presumably because they did not request comments or because they received funding on the first try) or that they did not use the reviewers' comments. Typical of responses are these: "Not used"; "NA--we received a grant"; "Not used by the present authors--not available to us."

Twelve percent of project directors reported that reviewers' comments were used in specific ways to change the emphasis or focus of the proposal.

The project directors cite specific changes they made in the areas of project management, budget, student involvement, faculty participation. Typical of responses are the following: "Original proposal involved 'writing science' skills. This was removed because reviewers said communications skills were not appropriate for NSF"; "Student involvement, tightened budget"; "They were extremely useful. Criticisms of institutional support, faculty strength in a particular area, and administration of the program were all addressed before the second proposal was submitted."

Ten percent of project directors reported that reviewers' comments were answered or refuted in the next proposal and/or some comments which were perceived as unhelpful, were ignored. This is in contrast to the answer above in that the emphasis here is on not accepting reviewers' ideas as opposed to accepting them. Typical of responses are these: "Some comments were refuted in the text of the second proposal"; ". . . not all comments were useful!"; "They were reviewed, evaluated, and addressed where it seemed warranted in the new proposal."

In Question Five we asked if project directors had participated in the development of the proposal. Ninety-seven percent had. We also asked how project directors who had participated had found out about CAUSE. Ninety-eight percent of project directors report that they heard about CAUSE from an office on their campus set up to aid faculty in getting grants. Such an office is known as an office of research service, an office of sponsored programs, or an office of grants management. Some project directors mentioned a grants officer who disseminated information about grant opportunities on their campus. Typical of responses are these: "The Director of Sponsored Research at my college alerted me to the conference"; "Also through our sponsored research office"; "Our development office circulates the information, too." It was typical of respondents to mention several sources of information simultaneously. A project director might well have responded to the item by saying he heard it from the Office of Sponsored Programs, from his dean, and via an NSF brochure. In such cases, the project director's response is recorded in each of those three categories.

Twenty-eight percent of project directors reported that they received information through an NSF publication or through a visit to their campus by an NSF team. By far the majority of these received information through a publication. Typical of responses are these: "NSF Guide for CAUSE proposal sent to me by the Chairman of the Natural Science Division"; "Through NSF program announcements"; "Received own copy of announcement."

Twenty-six percent of project directors heard about CAUSE through their college administration, usually the dean or dean's office or the department head. Typical of responses are these: "I think through the college administration"; "The dean of the college notified us"; "College president and chairman of Division of Science and Mathematics both pass on information received from NSF."

Fourteen percent of project directors reported that they heard about CAUSE through attending a meeting held by NSF. Typical of responses are these: "Attended regional meeting sponsored by NSF prior to start of program"; "I received notice from NSF about regional meetings on CAUSE prior to initiation of CAUSE by NSF"; "Attended NSF orientation in Denver."

We asked in Question Six who was primarily responsible for the development of the proposal. Sixty-six percent reported that a faculty group was primarily responsible. The next most frequently mentioned category (28%) was one faculty member only. Students were mentioned least often. Only 1% of project directors mentioned students as the group primarily responsible for the development of the proposal. In Question Seven, we asked project directors whether more than one department or group of faculty were interested in applying for CAUSE. Forty-eight percent said yes. Fifty-two percent said no. We also asked how the decision was made as to what department or group would submit. Sixty-one project directors responded to this item.

Eighteen percent of project directors reported that the proposal writing represented a cooperative effort among the relevant groups on campus. Typical of responses are these: "Both humanities and science were involved in developing the grant proposal. This, however, was a highly altruistic effort on the part of the English faculty who could not benefit from an NSF grant"; "We submitted a combined proposal with common purpose"; "We followed a multi-departmental approach--three departments deeply involved and four others somewhat involved."

Fifteen percent of project directors reported that external criteria were established whereby one proposal could be judged as best. Criteria mentioned include: which has the best chance of funding; which speaks most fully to the needs of the institution. In some cases, a selection committee was established and/or a competition was set up. Typical of responses are these: "As I recall, it was simply negotiated. Other departments concluded that our proposal had the best chance of funding"; "Proposal writing committee researched information from science departments and a decision was made by this committee to include only those ideas which would fit the guidelines of the CAUSE program"; "1) inter-college competition; 2) inter-university competition."

Fourteen percent of project directors reported that the proposal to be submitted was selected by the administration of their institution. Typical of responses are these: "Administrative decision"; "An ad hoc committee of administrators heard various requests and decided which would be allowed"; "Decision made by dean."

Ten percent of project directors reported that the item is not applicable to their situation, indicating, presumably, that only one department was interested in submitting, or that they did not know how a decision was reached.

Five percent of project directors reported that the submitting group was simply ready before other groups and that, therefore, their proposal was the one submitted. Typical of responses are these: "Only one of us had a 'ready to go' proposal"; "The group who wished to do the work submitted the proposal"; "We were ready to go, others weren't."

Five percent of project directors reported that the decision was made based on who was interested. Contributors, in other words, were self-selected. Typical of responses are these: "I canvassed faculty in all eligible departments. Those interested were included"; "None were excluded"; "All eligible academic areas were canvassed to see if they wanted to participate in computer program. The six that were positive were included."

A point can be made about these response categories: responses indicating one group's proposal was the first ready, that proposal writing was a cooperative effort, or that contributors were self-selected seem, generally, to come from departments who initiated the proposal effort at their institution, who were highly proactive in beginning the effort, and who invited others to join or to help. This is not always the case, but seems to be fairly common. Conversely, categories in which the decision was based on external criteria or made by the institution's administration seem to be reported by project directors from departments who were no more involved at the outset than one or more other departments or groups on campus and who submitted the proposal because theirs was the best or because it represented the interests and needs of all groups or because an administrative decision was made to select their proposal.

In Question Eight we asked project directors how staff members were selected to be involved in the CAUSE project. Ninety-three project directors responded to this item.

Thirty-three percent of project directors reported that staff were selected according to how well their expertise fit the project or according to the subject area of the faculty member or according to the faculty member's teaching area. Typical of responses are these: "Subject area and background"; "The participants were members of the Natural Science Department"; "Those faculty who were teaching the lower-level physics and chemistry courses enrolling those groups of students needing remediation."

Twenty-eight percent of project directors reported that staff were self-selected; anyone interested was included. Typical of responses are these: "All interested participants from the faculty were included"; "Based on expressed interest in the project"; "Those faculty who were interested."

Twenty-three percent of project directors reported that staff were selected by an individual in authority: the president, the dean, the department head, the project director herself. Sometimes the project director reported that she is the only staff member and was appointed by the dean or president. Obviously, this response category is in extreme contrast to the one above where staff was self-selected. Typical of responses are these: "I, as department chairman, informally approached various staff members to ask that they be involved in the project"; "I invited qualified people to participate"; "Dean invited staff members to participate."

Sixteen percent of project directors reported that staff were selected on the basis of proven commitment to the project, on a track record of dedicated work, perhaps on the basis of good work on the proposal effort. Typical of responses are these: "Coordinator was the faculty member who did 80% of proposal preparation"; "Interest and involvement in previous activities"; "Those preparing the proposal."

In Question Nine we asked project directors about their experience in managing externally-funded projects in a higher education setting. Forty-two percent reported that they had managed at least one instructional improvement project while 39% reported that they had managed at least one research project prior to CAUSE. Forty-one percent reported that this was their first experience at project management.

In Question Ten we asked about the previous experience of project staff with instructional improvement projects. Forty-two percent reported that some project staff had previous experience while 46% reported that most project staff had previous experience. Only 1% of project directors reported that none of their project staff had previous experience.

In Question Eleven we asked what additional help project directors would have found useful in planning their project or preparing their proposal. Eighty-seven project directors responded to this item.

Thirty percent of project directors reported that they needed no extra help. Typical of responses are these: "Didn't need help"; "Maybe a proposal review but we didn't really feel any need"; "Outside assistance probably was not needed."

Eighteen percent of project directors reported that they would have found helpful some aid in organizing project activities, developing the budget, and allocating staff time. Typical of responses are these: "We probably could have used help in organizing and budgeting a project of this size"; "I would have benefited greatly in advice on budget development and evaluation"; "Someone experienced in project management who could give helpful advice on organizing the tasks involved."

Ten percent of project directors reported that it would have been helpful to have access to proposals for projects similar to theirs or to visit projects at other institutions or to talk to faculty doing similar things at other institutions. Typical of responses are these: "1) Assistance from directors of projects which had been selected for funding; 2) sample copies of proposals similar in nature to the one to be submitted would have been helpful"; "Similar projects in existence"; "Information on previous NSF funded projects that produced instructional materials similar to those we are producing and using."

Eight percent of project directors reported that they could have used outside consultants in a variety of areas not mentioned in any of the other response categories. Typical of responses are these: "Consultants to advise in facility design and equipment acquisition"; "Person or persons familiar with some specialized computer hardware-technical expertise."

Implications. Project directors and staffs are generally experienced. Only 1% of project directors reported that no one on the staff had had previous experience. It may be somewhat of a surprise, however, to find that a full 41% of project directors had never managed an instructional improvement project or a research project.

The communications network among science educators we had postulated may be less a reality than we had thought. Only 3% of project directors listed faculty contacts as the way they learned about CAUSE. However, "hidden" in comments like "through NSF program announcements" and "received own copy of announcement" may be the assumption of a large and active network involvement. We do not have sufficient information to say for certain.

The supposition that successful proposals are submitted two or even three times before funding is supported. Sixty percent of project directors reported that their institution had tried before either with the same proposal or with another. Apparently practice is helpful as is learning what NSF really requires. Forty-five percent of project directors requested and received reviewers' comments on their non-funded proposal.

Project Implementation

This section deals with issues of implementation: how close to the proposal is the project as it exists in practice? What activities seem to contribute to project success? What difficulties have project directors experienced? What kinds of incentives do institutions provide for participants in CAUSE? Questions which were explored in this section were:

- Will project directors be successful to the extent that they understand formal and informal power structures within the institution and are able to use them effectively?

-Has there been general difficulty in the articulation between proposal and implementation especially in the areas of the management plan and the timetable?

-Are good staff relations and continuity important to project success?

-Are incentives provided to CAUSE project staff important for project success?

It should be noted that these questions could not be directly measured in the survey; we could not learn whether those project directors who understood and used the institutional power structures were more successful than their colleagues who did not. We could, however, learn whether project directors perceive this as an important element of project success.

In Question Twelve, we asked project directors to identify areas in which the proposal accurately or inaccurately reflected project activities as they really take place. The three areas identified as least accurately reflected were: timetables or timelines (33% reported that the proposal does not accurately reflect the reality); evaluation plans (17% reported that the proposal does not accurately reflect the reality); and the budget (16% reported that the proposal does not accurately reflect the reality).

The components which were most accurately described in the original proposal were: project activities (99%) and project objectives and goals (99%). Project management was reported by 97% of project directors as accurately reflected in the proposal. We also asked project directors to report the ways in which their project had been modified during its operation. Ninety-one project directors responded to this item.

Twenty-six percent of project directors reported that they have made no modifications or that the modifications have been slight or that modifications were built into their original plan in the form of a strategy of formative evaluation. Typical of responses are these: "The flexibility inherent in our project easily permits this"; "There have been no significant modifications of operation"; "No, project moving as proposed"; "Project has been modified as planned by incorporating student feedback."

Nineteen percent of project directors reported that there have been changes in methods, strategies or implementation. Sometimes they mean by this that the planned method was unsuccessful and another had to be tried. Other times they mean that the project took an unexpected direction in its implementation phase. Typical of responses are these: "After the first year of implementation, the mastery method used proved ineffectual. The mastery method had to be discarded in favor of other methods"; "Most modifications have been . . . daily management of the project"; "Computer projects and activities have expanded and developed new dimensions as a result of implementation of proposed activities."

Thirteen percent of project directors reported changes in personnel or in staff roles. This category includes those projects that gained or lost in numbers of staff persons and those projects whose staff members took on unanticipated roles and responsibilities within the project. Typical of responses are these: "Some shifting of personnel, sizes of development of teams"; "Role of media center director minimized (lowered to near zero!) due to characteristics of person hired being unsatisfactory"; "We have had to shift personnel."

Thirteen percent of project directors reported change in schedules and timelines. Usually, the change has been in the direction of extending deadlines. Typical of responses are these: "Grant was one month late (award date). That and other causes made us move several items back by six months to one year"; "Slight modifications in the timetables . . . were made"; "Our building timetable is behind schedule."

Twelve percent of project directors reported modifications in equipment or facilities. Typical of responses are these: "Some individualized projects and equipment have not worked well and some have not been widely used. We have already made adjustments by modifying equipment"; "Our architects' original plan of the facility had to be somewhat modified during the construction phase of the project."

Twelve percent of project directors reported that changes have been made in materials, software, or course content. Typical of responses are these: "Added material on computer-controlled experiments"; "Certain media purchases were changed slightly"; "We have experienced some difficulty in securing instructional materials including films which can be used in support of project goals."

In Question Thirteen, project directors were asked to identify project activities that are important to project success from a list of activities. Those most frequently chosen are: teaching related to the project (92%); designing instructional materials (88%); working collaboratively with project staff (83%); evaluating the project (83%); designing facilities and selecting equipment (83%).

Those activites cited most often as somewhat or totally unimportant to project success are: writing reports and related administrative paperwork (59%); advising students (40%); working with non-project faculty (36%); describing the project to others (28%); and seeking financial support for the project once NSF funds are gone(28%).

Clearly project directors perceive issues having to do with actual implementation as those most crucial for project success, while administrative detail, dissemination and future efforts at continuation are seen as more peripheral.

We also asked project directors to list other activities important to project success not included in our list. Fifty-three project directors responded to this item.

Eighteen percent of project directors reported that various kinds of communication make for project success. These include: keeping faculty informed; promoting student participation; giving and receiving project information with faculty at other institutions; promoting institutional support for the project; advertising the project; and communicating with NSF. Some responses are the following: "Conferring with colleagues at other institutions who have similar problems, projects, etc."; "Advertising availability of services"; "Keeping students cognizant of the purpose of the various aspects of the project"; "Careful (and continuous) explanation of project to staff, administration and students."

Seventeen percent of project directors reported that the items listed had adequately covered activities important to project success. They could think of no others. Typical of responses are these: "Seems to cover them O.K."; "None come to mind."

Eleven percent of project directors emphasized getting and keeping the cooperation of the faculty and administration. Typical of responses are these: ". . . working with project (faculty) participants is by far the most important"; "Developing an atmosphere for the project in which faculty will participate--very important"; "Detailed planning of goals prior to proposal and acceptance of these goals by administration."

Five percent of project directors reported that getting and keeping a dedicated and knowledgeable project staff is important to project success. Typical of responses are these: "Making sure that very good people are involved in the project. If the best people on campus are involved, the project is done right and other faculty will accept it"; "The nature and quality of direct work by individual staff members is of crucial importance to project success"; "Recruiting project staff of high level of competence and commitment is the most crucial aspect of the project effort."

It is interesting to note that all these response categories except the second are related to human relations issues: good communication, both giving and receiving accurate information, and gaining support and commitment from relevant groups on campus. It is possible that these issues became important to project directors as the project developed and were not necessarily anticipated at the outset.

In Question Fourteen we asked project directors to tell us whether they had described their project to others outside their institution. Ninety percent reported they had. We also asked them what they had described as the most important outcome in describing their project to others. Eighty-six project directors responded to this item. There was an unusual diversity of response.

Twenty-four percent of project directors reported that the most significant outcome is an improved science curriculum. Typical of responses are these: "Significantly improved curriculum for non-chemistry majors"; "Outcome: laboratory exercises designed"; "The most important (is/was) the changes in curriculum made possible by the facility and by the faculty released time."

Nineteen percent of project directors reported the most important outcome is the acquisition and development of, use of, or improved attitudes toward computers or computer-related materials. Typical of responses are these: "The demonstration of the important role that computers . . . and media can play in improving undergraduate science education is increasingly important since rapid changes in technology and falling costs present great opportunity"; "Developing computer-based instructional materials which will enhance instruction in the basic sciences"; "Introducing computer assisted and A.T. materials."

Fourteen percent of project directors reported that the most important outcome is new or improved equipment or facilities. Typical of responses are these: "Ability to provide students with equipment to better view and record scientific events and share data with colleagues in larger groups"; "Renovation and equipment purchases"; "Availability of teaching facilities that would have been impossible without the CAUSE grant."

Fourteen percent of project directors reported that the most important outcome is improved instructional options for students. They mean things like more instructional strategies being in use and more instructional choices for students. Typical of responses are these: "The benefits to students in individualization of instruction"; "More flexible approach to teaching"; "The individualization of instruction was the most important outcome. It has the obvious advantages of self-pacing and drill not available in the lecture mode of instruction."

Twelve percent of project directors specifically mentioned improved lab opportunities as an important outcome that they would describe to other institutions. Typical of responses are these: "The most important outcome of our project is to provide off-campus instruction in laboratory science courses"; "Outcome: laboratory exercises designed. Our students need the hands-on experiences they can get in lab to make the lecture meaningful and practical for them"; "Involvement of students in laboratory demonstrations. Students' positive comments after a lab demo are dramatic. Comments like: 'The real thing', 'I didn't know you had a lab like this', etc."

Ten percent of project directors reported that the most important outcome is improvements in the education of non-majors and less well-prepared learners. The emphasis is on the successful accommodations of the program to student learning needs. There is, clearly, an overlap between this category and the preceding one. But the emphasis is different. Learning problems are the emphasis in this category. Typical of responses are these: "Making science 'real' to non-science majors--this is important because the science major population on campus is usually small and the impact of science on all is great"; "New alternatives to dealing with math competence and math anxiety in students"; "The improved success rate of 'slow learners and average students'--the whole emphasis of the project was concerned with this."

Ten percent of project directors reported the most important outcome as improved student attitudes toward science and toward their courses. Typical of responses are these: "A dramatic positive change in student attitude toward laboratory exercises in science because motivation is a big issue in science education today"; "Students' positive comments after a lab demo are dramatic"; "The interest and excitement generated by the 'applied science projects' has been impressive."

In Question Fifteen we asked project directors to rate a list of difficulties as to the level of seriousness of each one. Those difficulties which were rated as serious or critically serious by 13% of project directors or more are: lack of sufficient time to complete planned activities (21%); reluctance of important department or school administrators to commit themselves to our project (16%); conflicting commitments on the part of project staff (15%); short supply or delay of materials (13%); delay of formal approval of our project by NSF (13%); and communication problems within our institution (13%). Most of these have to do with cooperation and communication with groups or individuals important to project implementation. This is interesting in light of the finding that project success is often perceived as dependent on implementation activities and working collaboratively with project staff is the only activity having to do with interpersonal relations that received a high level of agreement among project directors as being important to project success.

It is important, too, to underscore the importance of the timelines to project directors. Lack of sufficient time to complete planned activities received the highest percentage of project directors rating it as serious or critically serious.

We also asked project directors to report any other difficulties they encountered that were not on our list. Sixty-four project directors responded to this item.

Eighteen percent of project directors reported that there were no other difficulties or that the item is not applicable.

Seven percent of project directors reported that a difficulty was the lack of cooperation from the faculty or portions of the faculty. Typical of responses are these: "Another difficulty has been slowness on the part of science faculty to make real use of the facility"; "Simply, one department is opposed"; "Cooperation of non-project staff in multisection courses affected by grant."

Six percent of project directors reported that changes in project staff have presented a difficulty. Typical of responses are these: "Lack of continuity in project staff, due to promotions, resignations, etc. (critically serious)"; "Personnel turnover"; "Unexpected turnover in personnel."

Four percent of project directors reported a lack of cooperation from the administration as a difficulty. Typical of responses are these: "Non-cooperativeness by some lower level school administrators"; "Reluctance of university administrators to accept the management and work under this project as a rewardable scholarly activity for its faculty."

In Question Sixteen we asked project directors to report the most serious difficulty they had encountered on their CAUSE project. Ninety project directors responded to this item.

Twenty-one percent of project directors reported that delays or missed deadlines or too little time in which to complete activities presented the most serious difficulty. Typical of responses are these: "There were significant manufacturing errors and delays in the production of our two mobile science laboratories"; "An extension of time will be requested to complete the development of one particular course"; "Delays produced by our Media Materials Center"; "Because of 'start-up time' necessary for the project, we have found ourselves somewhat short of time."

Thirteen percent of project directors reported staff problems as the most serious difficulty. They mentioned such issues as: confusion over responsibilities, conflicts among staff members, and too little productivity as a result of competing demands. Typical of responses are these: "Lack of understanding of responsibilities by some top level project personnel"; "Conflicting commitments on the part of project staff"; "Hiring the wrong person."

Thirteen percent of project directors reported that their greatest difficulty has been getting the cooperation of affected faculty. Typical of responses are these: "Our project includes five departments. One department has been reluctant to utilize program fully"; "Communicating . . . to faculty members the opportunities for enriching the education of our students"; "Placating geology department (unsuccessfully)."

Twelve percent of project directors answered in part or wholly by referring to an earlier question. Most often they referred to the question immediately above which asked them to report any other difficulties they encountered that were not on our list. This probably indicates that many project directors saw no meaningful difference between that question and this one asking them to report the most serious difficulty they had encountered.

Eight percent of project directors reported a lack of cooperation from the administration as their most serious difficulty. Typical of responses are these: "Failure of most institutions to fulfill matching commitements except on paper"; "I have been pleading for months with the administration either to raise the funds as part of the match or to allow me to request a transfer of funds. They have done neither"; "The college's method of handling the NSF funds."

Eight percent of project directors reported that an inadequate budget is their most serious difficulty. Typical of responses are these: "We didn't request travel money. Has not been resolved"; "Our initial budget was inadequate and I had to ask NSF for more money. The 30-day waiting period was the most suspenseful time I had ever spent"; "Shortage of funds in grant for cost of building renovation obtained from state building contingency fund."

In Question Seventeen, we asked project directors to identify what areas of expertise not available to them would have been helpful. Twenty-seven percent of project directors indicated evaluation as an area; 23% indicated computer applications. These were the most frequently mentioned areas of expertise.

In Question Eighteen, we asked whether incentives were provided by the institution for working on CAUSE. Fifty-five percent of project directors said no; 44% said yes. We also asked those project directors who answered yes to describe those incentives. Forty-six project directors responded to this item.

Twenty-two percent of project directors reported that incentives have been in the form of released time for faculty working on the project. Some stated that released time was written into the proposal. Others did not indicate whether this was the case. Typical of responses are these: "Released time from regular teaching responsibilities was given to me while I was project director"; "Released time (as written into the proposal)"; "Also some 'real' released time for them (associate directors)."

Sixteen percent of project directors reported that incentives were in the form of recognition and encouragement from administrators and colleagues. Typical of responses are these: "General encouragement, recognition"; "Just recognition. I think that my local reputation was enhanced considerably"; "The project has been a focus of activity and has received both written and verbal compliments from administrators."

Seven percent of project directors reported that participating faculty receive summer support and/or funding for project-related activities. Typical of responses are these: "Stipends for faculty participation in workshops"; "Professional development support"; "Funds to attend professional meetings to report on project activities"; "We can pay summer salary for those doing curriculum and course development on the project."

Five percent of project directors reported that incentives have been in the form of merit raises or stipends awarded for winning the grant. Typical of responses are these: "Our institution provides a small stipend to those who submit and succeed in getting proposals funded"; "Salary increases"; "Merit pay for faculty."

We then asked project directors who had responded "no" what incentives would have been helpful. Fifty-one project directors responded to this item.

Seventeen percent of project directors reported that some released time or more released time than they received would have been a helpful incentive. Typical of responses are these: "It would have been helpful if additional release time were provided by the college to the faculty while the materials were being developed"; "Reduction in teaching time for grant prep and development"; "Release time from teaching to write the proposal."

Twelve percent of project directors reported that administrative encouragement and recognition would have been helpful. Typical of responses are these: "Administrative recognition of effort; administrative interest in the project"; "Interest in such projects"; "Just general administrative encouragement of participation, and administrative emphasis on importance of project activities to the college."

Eleven percent of project directors reported that financial incentives would have been helpful. These include merit increases, summer support and travel money for project-related activities. Typical of responses are these: "Recognition in the form of salary increases . . . for faculty who effectively participate in the project"; "Economists look for financial incentives. The college pushes us towards small-college academic pay scales"; "Additional summer stipends."

Seven percent of project directors reported incentives are not needed. The project and project outcomes provide their own reward. Typical of responses are these: "Incentives would have had no effect on outcome. Financial support to program by institution's president was positive and encouraging. Expected impact to academic program sufficient incentive"; "Doesn't really apply. CAUSE allowed us to do some things we wanted to do"; "I see no need for special incentives."

In Question Nineteen, we asked project directors to report on how much release time has been covered full or part time by CAUSE monies. This item did not generate as much information as had been hoped for. The primary difficulty with the item is in its imprecise wording. We did not define what units of measurement we were looking for when we asked "How much faculty release time?" Consequently, project directors reported the information in non-comparable ways. Here are some of the ways project directors reported on release time: "Four half semesters and six summer terms to date"; "One-half time for project director; one-eighth time for project evaluator"; "Seven man-years."

An additional problem, at least for some project directors, was understanding what we meant by "CAUSE monies." In a couple of instances project directors told us that CAUSE monies did not cover release time, but matching funds from their institution did. We had meant any monies, NSF or matching, that were slated for the CAUSE project. One such response is as follows: "None--these came from matching funds."

Implications. Project directors probably do perceive the understanding and effective use of institutional power structures, both formal and informal, as important to project success. At the very least, the absence of such effective utilization is perceived as a serious difficulty. This is reflected in Question Thirteen where project directors listed communication and gaining the cooperation of relevant groups as important to project success; it is also implicit in such high rated difficulties (Question Fifteen) as: reluctance of important department or school administrators to commit themselves to our project, and communication problems within our institution.

Project directors do not generally believe that project activities are substantially different from those proposed except in the area of the timeline.

Good staff relations do seem to be important for project success. Eighty-three percent listed this as important and lack of good staff relations was cited as the most serious difficulty by 13% of project directors.

Incentives are important to project directors. Fifty-five percent reported that they had received no incentives. Of these only 13% reported that incentives were not needed.

Project Impact

This section explores what effect the CAUSE project has had on faculty, students, the science curriculum, and science facilities and equipment. Project directors were asked to describe what they expect the change to be and what impact has already been felt along each of these parameters. Project directors were also asked about unexpected changes and about what they might do differently if they were to start over again. In this section they were also asked to describe future funding plans for CAUSE activities. A question we asked was: are the most important changes in the areas of improved faculty/institutional relations and in student outcomes?

In Question Twenty we asked how faculty may have changed as a result of CAUSE. First, we asked project directors what changes they expected. Eighty-two project directors answered this question.

Twenty-three percent of project directors indicated that they expect faculty members to learn skills around course development, skills like individualizing instruction, developing courses, developing course materials. Typical responses include these: "They should become highly efficient and expert at developing learning materials"; "Faculty will (1) be aware of remedial needs of students; (2) produce instructional materials; (3) use instructional materials for remedial purposes"; "A move toward individualizing courses." Responses in this category stress the expectation that faculty will, as a result of the CAUSE project, spend more time and energy working with curricular issues, refining and modifying course materials.

Twenty-three percent of project directors mentioned that faculty members will develop more expertise and/or more positive attitudes toward using the computer for instructional purposes. Typical of the responses are these: "A more positive attitude toward using computing instructionally"; "Faculty should be more aware of the value of computer use and should adapt their courses to include such use"; "60 faculty know how to communicate with a time share computing system"; "More people will be interested in computers."

Nineteen percent of project directors expected faculty to learn to teach more effectively, to interact with students better, and to understand the needs of students more fully. This category is clearly related to the course development category above: both course improvement and better teaching are linked to improved student learning. However, while the emphasis in the earlier category is on the course, the emphasis here is on the interactions that take place between instructor and students. Typical of responses are these: "More student interaction with faculty"; "More attention to instructional methods"; "Recognition of students' difficulties with math."

Thirteen percent of project directors expected that faculty would expand their content knowledge to areas outside their immediate field of expertise. This category overlaps, to some extent, with the earlier category, improved use of the computer. Such a large number of project directors specifically cited knowledge of the computer that it was given its own category. Thus, the twelve project directors referred to here mentioned content areas other than computing. Typical of responses are these: "Project faculty should become more aware of and interested in science areas outside their individual expertise"; "More acceptance of experimentation and scientific aspects of psych"; "More knowledgeable about local labs and current applications of chemistry."

Twelve percent of project directors expected faculty to engage in new and more varied activities (teaching off campus, writing grant proposals, conducting more research) and participation in these activities would result in a greater sense of professionalism among faculty. Typical of responses are these: "Greater hands-on laboratory investigation"; "Greater involvement in lab-field activities"; "More faculty want to submit proposals to LOCI, ISEP, and CAUSE"; "More field and professionally oriented." It should be noted that six out of seven categories developed for expected faculty change include new skills or capabilities for participating faculty.

Next, we asked what change has already been observable. Ninety-one project directors responded to this item.

Twenty-one percent of project directors reported that faculty capabilities have broadened in a number of areas and that faculty have engaged in new activities. This category does not include use of computers or curriculum development activities. Typical of responses are the following: "Increased awareness, understanding, utilization of procedures; faculty development in terms of visiting speakers program"; "Learning one another's fields"; "Other faculty are updating their skills."

Twenty percent of project directors reported that an impact that has already been felt is that teaching effectiveness has been enhanced and faculty have a better relationship with students. It may be remembered that only 19% of project directors reported expecting faculty to improve their teaching and interact more effectively with students. Included are reports of improved student interaction with faculty. Typical of responses are the following: "Teaching effectiveness enhanced"; "Students are more eager to come and to stay in the lab"; "A better understanding of students."

Sixteen percent of project directors reported that an impact of the CAUSE project is that faculty have undertaken curriculum development projects. This is in contrast to the 23% of project directors who expect or expected faculty to undertake curriculum development projects. Typical of responses are the following: "Faculty have undertaken curriculum development projects in other areas"; "An increased interest and activity in revising courses along 'individualized approaches'"; "Instructional materials, i.e., books and films, have been secured."

Sixteen percent of project directors reported an increased use of computers and computer-related materials and/or an improved attitude toward computing. This is in contrast to the 23% of project directors who expect or expected improved attitudes and increased use of the computer and computer-related materials. Typical of responses are the following: "Most science faculty now mention the importance of computing, though only a few non-project faculty have yet to begin to adapt courses"; "Many faculty members in our department are now gaining that appreciation for CAI and auto-tutorial modes of instruction"; "More people are interested in computers and side effects have already emerged which are helping the physics department and can help the entire university in the near future."

Fourteen percent of project directors reported merely that the project has had an impact on target departments or that faculty have shown an interest without being more specific. Typical of responses in this category are the following: "Target departments have responded"; "Interest in what we are doing is noticeable."

Again, the most significant changes are reported as being new or broadened areas of knowledge or skill for faculty. Project directors most often observed changes in the area of improved teaching effectiveness and relationships with students; this change was the third most frequently cited expected change. Conversely, project directors report curriculum development as the third most frequently observed change while this was the most frequently reported expected change.

In Question Twenty-one, we asked project directors about changes in the curriculum. First we asked them what changes they expect or expected. Ninety-four project directors responded to this item.

Twenty-seven percent of project directors indicated that they expect or expected special components or features to be added to already existing courses. These include modifications like computer-assisted instruction, audio-visual components, labs. Typical of responses in this category are the following: "Inclusion of computer assisted learning modules"; "More observational activities in astronomy and biology"; "More emphasis on lab materials."

Seventeen percent of project directors reported that they expect or expected modifications or innovations or up-dating of already existing courses. This category is similar to the one above except that it is more general. Specific components are not mentioned; rather, the emphasis seems to be on modifying the entire course overall. Typical of responses in this category are the following: "More innovation in existing courses"; "Beginning courses are more organized and arranged in a prerequisite sequence; rigor of courses improved"; "Several courses would be strongly upgraded."

Sixteen percent of project directors reported that they expect or expected the greatest change in curriculum to be the provision of better opportunities for students to learn, more options, courses that better meet student need. Typical of responses in this category are the following: "Facilitation of independent study by students, increase of computer awareness by staff and students, interdisciplinary functioning enhanced"; "More flexible learning modes available through Learning Research Centers to meet variable needs of students"; "Greater emphasis on individual problem solving in small groups--less on information.'

Twelve percent of project directors reported that they expect or expected development of specific new courses or kinds of courses to meet identified needs. Typical of responses in this category are the following: "Three long-needed courses have been developed"; "Additional courses would be added"; "Development of several new courses."

Next we asked what impact had already been felt. Eighty-three project directors responded to this item.

Nineteen percent of project directors have observed that better options, services and opportunities now exist for students than before the initiation of the CAUSE project. This is the most frequently observed change, but was only the third most frequently expected change. In terms of absolute numbers, 15 project directors out of 94 expected to see better options for students while 18 project directors out of 83 report actually observing this change. Typical of these responses are the following: "Tutorial service is available"; "More flexible learning modes available through Learning Resource Centers to meet variable needs of students"; "There has been a significant increase in CAI and A/T use by our students."

Eighteen percent of project directors reported additions of new components or features to existing courses. This is in contrast to the 27% of project directors who expect or expected the addition of components to courses. One explanation might be that several projects are new and implementation has just gotten underway. Typical of responses in this category are these: "Audiovisual techniques are now used in all freshman and sophomore level labs"; "Courses are now modularized"; "All science departments except one now include computing in at least one course."

Fourteen percent of project directors reported that new courses, sequences or kinds of courses have been developed. Strangely, only 12% reported expecting this kind of change. Typical of responses are these: "Several courses have been designed to assist students"; "Three long-needed courses have been developed"; "Introduction of new courses . . . in environmental science courses."

Eight percent of project directors reported, simply, that proposed activities are being implemented; that what is being done in the area of curriculum change is in the expected direction. This is in contrast to 5% of project directors who reported that they expect or expected to implement proposed activities. Typical of responses are these: "Generally more than expected"; "Impact in all areas"; "The changes are just being fully implemented this year."

Eight percent of project directors reported that the question is not applicable or that it is too early to measure impact yet or that impact is not in the expected direction. Typical of responses are these: "Intended impact not observed"; "Too early to see much"; "Little use to date."

Eight percent of project directors reported a higher enrollment and student interest. Only 4% of project directors reported expecting this change. Typical of responses are these: "Students and prospective students are inquiring about the potential if the faculty are interested in getting involved"; "An excitement about the uses of computer for laboratory work"; "More students completing chemistry course."

In conclusion, project directors actually experienced improved options for students, the addition of new components to existing courses and the development of new courses as the three most frequently mentioned changes and in that order. They expect or expected to experience addition of new components to existing courses, modifications of existing courses, and improved options for students as the three most frequent changes and in that order.

In Question Twenty-two, we asked project directors about changes in equipment and/or facilities. First we asked what changes they expect or expected. Eighty-two project directors responded to this item.

Twenty-two percent of project directors reported that they expect or expected to obtain new equipment and/or facilities exclusive of computers. Typical of responses are these: "Obtain sufficient undergrad instructional equipment in physics. Obtain facility for individualized instruction"; "When our new facility is completed, we will have a good bit of equipment available for student use"; "To be able to have science equipment and supplies available for use in off campus locations."

Twenty percent of project directors reported that they expect or expected changes in science equipment and/or facilities to bring about instructional improvement. Typical of responses are these: "With major items of equipment acquired...more interesting and sophisticated experiments can be included in the laboratory work"; "A curriculum change that will make our students just as compteitive as other college graduates"; "Greater use of individualized instructional activities with equipment."

Sixteen percent of project directors reported that they expect or expected to upgrade, expand or improve existing equipment and facilities exclusive of computers. Typical of responses are these: "Significant improvement in middle level instructional instrumentation"; "Better equipment for independent learning environments"; "Renovations of science buildings to accommodate modular format."

Thirteen percent of project directors reported that they expect to obtain new computer equipment. Typical of responses are these: "Mini-computer time share systems"; "Computers added to available equipment"; "Mini-computers should be available in departments and then should be common language for them."

Ten percent of project directors reported that they expected little or no change or that the question is not applicable. Typical of responses are these: "Too early for evaluation"; "No change in equipment or facilities expected."

Next, we asked what impact has already been felt. Eighty-four project directors responded to this item.

Twenty-three percent of project directors reported that an observed change is improved instruction. This is in contrast to 20% who expect or expected to see improved instruction. This change is the leading observed impact and the second most frequently cited expected impact. Typical of responses are these: "In the process of upgrading equipment to allow student interfacing with computer"; "Much improved lab facilities and equipment makes their work easier and more enjoyable"; "We can now offer a wide variety of off-campus science laboratroy courses."

Fourteen percent of project directors reported the addition of new equipment/facilities. This is the second most frequently observed change. In contrast, 22% of project directors reported expecting this change and it is the most frequently cited expected change. Typical of responses are these: "We now have a good range of AV materials and equipment"; "Some equipment has been purchased"; "Installation is complete and the center is providing good support for the project."

Eleven percent of project directors reported that there has been no observed impact or that the item is not applicable. This is the third most frequently cited category in contrast to 10% of project directors who expect or expected no impact and where this category is the fifth most frequently cited category. Typical of responses are these: "We do not intend to purchase these yet"; "None yet"; "Too early for much."

Ten percent of project directors reported the acquisition of new computer hardware and/or software. This is in contrast to 13% of project directors who expect or expected new computer equipment. For both questions, this is the fourth most frequently cited category. Typical of responses are these: "Mini-computers, time-share systems, 12 terminals and 12 microcomputers"; "Development of the CAUSE Instructional Computing System has provided computer support for computing."

Ten percent of project directors reported that equipment and/or facilities have been expanded, upgraded or improved. In contrast, this category was the third most frequently cited expected change and was mentioned by 16% of project directors. Typical of responses are these: "The renovations and some of the equipment are in place"; "Release of CIP funds for renovations."

In Question Twenty-three we asked about changes in students. First we asked about expected changes. Eighty-five project directors responded to this item.

Just over half of the project directors responding expect the

CAUSE project to result in improved training for students and greater student competency. Typical of responses are these: "Improved training of non-chemistry majors"; "More actual learning in physics labs by the student"; "Computer literacy for 100% of student body"; "All students better informed and knowledgeable in microcomputers and in computer graphics."

Twenty percent of project directors, a far more modest number, expected student attitudes toward specific courses and toward the science disciplines in general to become more positive and for enthusiasm toward science to increase. Typical of responses are these: "Greater acceptance of physics lab for non-majors"; "Increased enthusiasm and comprehension"; "Greater interest in activity centered instruction enhanced by AV technology."

Eleven percent of project directors reported that they expect a higher student enrollment in science courses as a result of CAUSE. Typical of responses are these: "To increase the number of students in rural towns and locations that could take science courses"; "More students to take part in science activities"; "Hopefully, greater student participation in CAB science courses."

Ten percent of project directors expected students to become more proactive, to take a more active role in their education and to participate voluntarily in science-related activities. Typical responses are these: "Greater participation in evaluation and curriculum development"; "Greater student involvement in the learning process"; "Greater independence, enthusiasm, initiative, and career motivation."

Next, we asked what impact has already been felt. Eighty-eight project directors responded to this item.

Thirty percent of project directors reported that they have observed improved training for students and/or improved student competency. This is in contrast to 50% of project directors who expect or expected this change. This category is the most frequently cited for both expected and observed changes in students. Typical of responses are these: "Improved training of both non-majors and majors"; "They appear to be learning the material somewhat easier"; "More prepared for upper level courses."

Twenty-one percent of project directors reported that their students are now more proactive and participate more actively in science-related activities. This is the second most frequently observed change in contrast to its being the fourth most frequently expected change where it is cited by only 10% of project directors. Typical of responses are these: "More students are at the computer"; "A number of students have, without prompting, asked for personal accounts on the system for individual projects"; "Students are spending significant time in the learning centers."

Sixteen percent of project directors reported that the item is not applicable or it is too early to tell or they do not know or there has been less impact than has been expected. Typical of responses are these: "Too early to assess this"; "Probably somewhat less than anticipated"; "Don't know. One hopes there are some who are doing this."

Fourteen percent of project directors reported observing improved student attitudes toward science courses. In contrast, 20% of project directors expect or expected this change and it was the second most frequently cited expected change. Typical of responses are these: "Student opinion polls show appreciation for audio-visual techniques"; "The students are more aware, alert, interested"; "Increased enthusiasm and comprehension."

Ten percent of project directors reported, simply, that implementation of activities is proceeding and/or that students are changing or have changed. These project directors are not specific about the direction of the change. Typical of responses are these: "Seems to be working as planned"; "They have"; "I think this has been accomplished in part through the new translations made available through the project."

In Question Twenty-four we asked project directors about whether unexpected changes have occurred as a result of the CAUSE project. Seventy-nine project directors responded to this item.

Twenty percent of project directors reported that no unexpected changes have occurred as a result of CAUSE. Typical of these responses are the following: "Not really"; "Nothing magnificent comes to mind"; "Not as yet."

Sixteen percent of project directors reported that spin-offs from CAUSE have occurred, or that the project has inspired people outside the project to introduce innovations. Typical of responses are the following: "We are now contemplating the introduction of a computer science major into the curriculum"; "Use for the handicapped"; "Have been able to purchase copies of industrial films with restricted funds"; "Have developed a proposal for a workshop on 'real world' chemistry for high school teachers."

Eleven percent of project directors reported that there has been a higher rate of faculty acceptance and/or use than expected. Typical of responses are the following: "Some faculty in the social science areas have utilized facilities with unexpected high frequency"; "In a few cases faculty acceptance has been better than I expected"; "Non-science and secondary instructors are also using computers"; "Initial positive non-department faculty response has been very gratifying and totally unexpected."

Eight percent of project directors reported a higher rate of student use and/or acceptance than they expected. Typical of responses are the following: "Use of tutor's services has increased"; "The collection and correction of study guides has increased student participation"; ". . . the students have been trying much harder once they realized how hard we are trying for them."

Seven percent of project directors reported that the general impact of the project and/or its impact on the campus or local community has been greater than expected. Typical of responses are the following: "Impact of various projects greater in general than predicted"; "Greater community interest in nature of project than expected"; "Community and high school awareness activities have been tremendous and very gratifying."

In Question Twenty-five we asked what, if anything, project directors would do differently if they had the opportunity to start their CAUSE projects over again from the beginning. Ninety-three project directors responded to this item.

Twenty-two percent of project directors reported that if they had it to do again, they would do better, more effective front-end planning. Typical of responses are the following: "I think we would plan equipment and renovation much more carefully. Some things have not worked the way we thought they would or have not had the impact we thought they would have"; "Perhaps more firmly established goals"; "I would . . . do more up front planning and discussion including a wider audience than before and would try to involve more people in production of materials"; "I would have tried to start earlier."

Seventeen percent of project directors indicated that they would make no changes. Typical of responses are "Nothing"; and "Nothing of consequence."

Sixteen percent of project directors reported that, if they had it all to do again, they would build in more support for faculty and staff. Typical of responses are the following: "Include more released time for director; include at least half-time secretary"; "I would request summer support for the project director since this project has required a significant amount of my summer time with no support"; "Arrange to 'pay' faculty for a completed 'product' rather than for time on project--try to get institution to provide extra pay for some faculty."

Fifteen percent of project directors reported that they would increase the budget. This change is clearly related to the category above since increased support implies, often, increases in budget. In that category, however, project directors express need for support only, while here they specifically refer to the budget. This latter category, furthermore, does not include increased support for faculty and staff. Typical of responses are the following: "Would have constructed budget a little differently. The project overburdens the present TICCIT disc drives, so we would include cost of an additional drive"; "Budget for more consulting time"; "Increase budget for library acquisitions."

Fourteen percent of project directors reported that they would make changes in staffing if they had it to do over again. These changes range from adding experts in particular fields to replacing staff who were difficult to work with. Typical of responses are the following: "Nothing major except try to hire a media center director more suited to our goals"; "Would have included a computer programmer for development of software to our specifications"; "Searched a little longer for the right person before causing a possibly disastrous move."

Twelve percent of project directors reported that they would change the way in which their project was implemented. They would change the strategies they used or the project activities or the equipment they purchased. Typical of responses are these: "Buy micro-computers in lieu of time share"; "I would redesign the greenhouse and relocate it. I realize ways in which more efficient use of space could be made"; "I would do a pilot project first."

In Question Twenty-six we asked whether anyone at the institution has or would seek further funding when CAUSE funding expired. Seventy percent said yes. We asked those project directors who answered "Yes" to report what sources they would seek funding from. Seventy-two project directors responded to this item.

Thirty percent of project directors reported that they will seek further funding from the National Science Foundation, perhaps from the CAUSE program, perhaps from other NSF programs. Typical of responses are these: "NSF programs for public school teacher participation in the project"; "NSF-ISEP, perhaps CAUSE again"; "NSF: not the same project, but related."

Twenty-eight percent of project directors reported that they would seek funding from private foundations, from individuals and/or from corporations. Typical of responses are these: "Private foundations and individuals"; "Private gifts and grants"; "Funding will be sought from local industry. Endowment funding through the Grote-Chemistry Fund will be designated to support the continuation of activities."

Twenty percent of project directors reported that continued funding will be provided by their own institution. Typical responses are these: "University is carrying the modest expense that will continue"; "University project funds"; "We are aware that we will need to make revisions of our videotape at some point in time. Departmental funds will be used to make these revisions."

Sixteen percent of project directors reported that they do not know at this time where funding will come from. Typical of these responses are the following: "Don't know at this time"; "We have not yet determined the direction we will take"; "Too soon to consider. Next fall we'll evaluate the project, make projections as to amount that will be completed at the project's end, and then determine feasibility of further funding and type of funding."

Twelve percent of project directors report that they will seek funding from federal agencies other than the National Science Foundation. Typically mentioned are: NIH, FIPSE, NIE, USOE, NASA.

We then asked those who answered "no" whether activities started under CAUSE would continue when CAUSE funding has ended. Thirty-six project directors responded to this item.

Thirty-eight percent of project directors reported that they will be able to continue CAUSE activities after CAUSE funding has ended because their institutions can support the project within the institutional budget. Typical of responses are these: "Yes, can operate with normal department of chemistry support"; "They will continue through university support. Essentially, CAUSE is providing the facility and getting us started in using it. We will continue to use (and upgrade at a lower level) the facility"; "Activities will continue anyway, since we developed a system which is now in place and costs little to operate."

Implications. It seems clear that, by and large, project directors are getting the impacts they expect. Most reported that they have not received any surprises and those that have occurred are in the area of getting more of a good thing than they expected: spin-offs from CAUSE, higher faculty acceptance. Project directors also seem confident of their institution's commitment to CAUSE after funding expires.

We were correct in postulating that student outcomes are an important change (Question Twenty-three). Project directors enthusiastically report that student performance has improved and that students have become more proactive in their attitudes.

Project Evaluation

There is only one question on evaluation (Question Twenty-seven). It is a series of statements about evaluation with which we ask project directors to indicate their level of agreement. We had questioned whether project directors are generally confused about what NSF means by evaluation. The statements which received the most agreement were: evaluation is important to the institution in monitoring the effectiveness of projects of this type (93% agree); project evaluation is best accomplished and most highly useful when it is conducted internally by project personnel in an ongoing manner (72% agree); evaluation results have been used to change some of the activities and/or outcomes of this project (68% agree); a clear and thorough description of our project will meet CAUSE requirements for project evaluation (47% agree). The statements which might indicate unwillingness to participate in evaluation activities received a high level of disagreement: formal evaluation activities take up too much time, effort, and money on our CAUSE project (68% disagree); project evaluation means conducting activities which have little or no usefulness to our CAUSE project staff (87% disagree); given the nature of our project evaluation is really an irrelevant activity (88% disagree).

Implications. These results, together with the fact that evaluation was identified by 83% of project directors as important to project success points to a higher level of appreciation for formative evaluation than we expected as well as a much higher level of acceptance of evaluation as a useful activity.

However, three items indicate that there is some difficulty with project evaluation. Thirty-nine percent of project directors reported that evaluation activities have not gone as planned; 37% reported that they would need more money and staff to do the kind of evaluation they would like; and 35% reported that evaluation is being done primarily to meet CAUSE requirements for project evaluation.

Recommendations

The final section of the survey consists of three questions aimed at eliciting from project directors some recommendations on CAUSE. The first two items asked project directors to make recommendations to potential project directors concerning how to promote project success and how to deal with evaluation. The third item asked project directors to make one suggestion to the NSF-CAUSE program office to improve the CAUSE program.

In Question Twenty-eight we asked what strategies for promoting project success they would recommend to a prospective project director. Eighty-seven project directors responded to this item.

Twenty-four percent of project directors recommended that, for project success, project directors should make sure that management and authority issues are clearly understood by all relevant actors. Issues having to do with who should do what and who has final authority need careful working out. Project directors need to understand the principles of good management. Typical of responses are these: "Have authority and responsibility confined to well-defined areas or units of the institution"; "Keep involved faculty reporting to you so you have a handle on who is doing their part and who isn't"; "Recommend careful attention to management procedures."

Twenty-one percent of project directors suggested that good front-end planning is important to project success. Typical of responses are these: "Make sure project is well-planned"; "Planning is crucial"; "A good plan, clearly stated."

Eighteen percent of project directors would advise a prospective project director to secure the participation and commitment of the faculty. Typical of responses are these: "Make sure all individuals . . . who will be affected by the project are in agreement (or at least not opposed to) the project"; "Gain support from involved faculty"; "Be sure that involved faculty members are fully committed to the program and know what their roles will be."

Fourteen percent of project directors reported that a project director should get the cooperation and commitment of the administration. Typical of responses are these: "It is important to gain support/commitment of the institution"; "In our case, experience in the ways of administrators"; "Keep the dean informed."

Fourteen percent of project directors recommended careful implementation as a factor in project success. Careful monitoring of project activities and attention to detail are important. Typical of these responses are the following: "Success depends on keeping track of all activities going on in the project and being able to solve problems in their minor stages before difficulties are encountered"; "Lots of attention to ongoing details"; "Know in detail what project development will be and how to do it, but be flexible enough to change when this seems advisable."

Eleven percent of project directors reported that an important element of project success is the careful selection of staff. Typical of responses are the following: "The selection of staff is . . . important. Good plans and uncommitted staff lead to problems"; "Choose good personnel"; "Screen prospective staff members in an attempt to maximize commitment to the project."

In Question Twenty-nine we asked what recommendation they would make to a prospective project director on CAUSE project evaluation. Eighty-eight project directors responded to this item.

Twenty-two percent of project directors suggested that an evaluation should make use of outside experts. Typical of responses are these: "Get someone to help you that knows the jargon"; "Evaluation is hard work and requires expert advice. If you have it on campus--use it and rely on it. If you don't, find it"; "We have been well satisfied using an off-campus three-man evaluation team with expertise in specific areas of grant emphasis."

Twenty percent of project directors recommended that the project director be clear about the purpose(s) for evaluation and be realistic about the limits of evaluation. Typical of responses are these: "Don't try collecting too much data. Collect only what you need and then use it"; "Be much more modest (than we) in plans for evaluation"; "Develop a reasonable and relatively quantitative evaluation plan--not a lengthy and irrelevant plan."

Thirteen percent of project directors suggested that formative evaluation activities should be undertaken. Typical of responses are these: "Make your evaluation informative and ongoing. Have the evaluators involved from the start. Project likely will change course or stay on track because of ongoing evaluation"; "Product evaluation at various steps before finalizing can be most useful--allows for changes early which is cost-effective"; "Do not be afraid of evaluation and use it formatively throughout project, if project is done correctly it will be seen positively in a summative evaluation."

Thirteen percent of project directors recommended using internal people as evaluators. That is, they suggested that people from within the institution and/or the project are in the best position to make informed judgments about the program. Typical of responses are these: "Establish a viable steering and evaluation committee and keep them aware of all aspects of projects"; "Try to develop the team to do the evaluation using local talent--especially from other departments and programs"; "Do not go overboard on expensive hired evaluation, however, a small amount spent on local (but not associated with the project) evaluation help may be very useful."

In Question Thirty we asked what one recommendation project directors would make to the NSF-CAUSE office to improve the CAUSE program. Eighty-nine project directors responded to this item.

Forty percent of project directors reported that they would like to see more communication, sharing of ideas, and dissemination of information both among projects and between National Science Foundation staff and project directors. This might involve more meetings of project directors, more site visits by CAUSE staff, a newsletter describing project activities at various sites, or a handbook of NSF project management guidelines.

Typical of responses are these: "I would continue the annual meetings of project directors. This sharing of information is very helpful and it's too bad that only one meeting was held in the 76-79 period"; "Sponsor more exchange of ideas between groups of related CAUSE recipients. An annual discussion would be helpful--would prevent the necessity for everyone to rediscover the 'wheel'"; "Dissemination of information on all ongoing CAUSE projects"; "A regional representative of NSF to handle all aspects of grant management--many questions come up in the course of a project period which must be answered by competent NSF staff --available by phone."

Twenty-one percent of project directors reported that they have no recommendations, that NSF is doing a good job. (It should be noted that project directors frequently added glowing praises for NSF at the very end of the survey where they were invited to add any comments they wished.) Typical of responses are these: "None--all was fine"; "Our experience was ideal"; "Continue to be as direct and personable to work with! The CAUSE staff was great during my project--interested in its goal and allowing freedom to work it through."

Seven percent of project directors recommended less bureaucracy, less red tape, more flexibility for project directors. Typical of responses are these: "Opportunity to revise project direction after first year of funding on automatic basis"; "Do not limit institutions having three year grants to one grant but allow them to start on a second project during third year providing adequate support for both projects can be demonstrated. Priorities within institutions change and program should be flexible."

Five percent of project directors recommended changes in NSF funding policy. Typical of responses are these: "Review approved projects with idea of extending support of worthy projects (more $ if project is good)"; "Allow some follow-up grants to complete goals not fully realized after initial grant."

Five percent of project directors recommended changes in NSF's evaluation policy. Typical of responses are these: "Place more emphasis on the scientific and pedagogical content of the project and less on evaluation scheme"; "Be more reasonable and realistic in describing evaluation in the guidelines for proposals."

Table 3

Survey of CAUSE Project Directors
Percentages of Response
Fall, 1979
N=95

1a. The three most important planned outcomes of the CAUSE project.

81%	Curriculum additions/revisions
59	Equipment and facilities acquisitions
54	Individualized instruction
45	Computer applications
28	Faculty development
25	Remediation

1b. *Which of the six CAUSE project outcomes best describes your project?*

% of Total	% of Respondents	
28	31	Curriculum additions and revisions
23	25	Equipment and facilities acquisition
17	18	Computer acquisition/application
16	17	Individualized instruction
7	8	Faculty development
4	4	Remediation

2. History of CAUSE activities.

10%	Some of the activities on our CAUSE project were begun under support from another externally-funded project.
44	Some of the activities on our CAUSE project were begun on funds from our institution's budget.
40	No activities for this project were begun before the preparation of the proposal.
6	More than one response.

Note: Percentages may not add up to 100% due to rounding error or because project directors were free to give more than one response. Questions which appear in italic type had open-ended responses which were then categorized. Percentages are shown for both the total number of survey respondents and the number of respondents to the question.

3. Institution submitted a proposal(s) to CAUSE before this one was funded.

38%	Yes, another version of the current project proposal was submitted.
5	Yes, a proposal for another project in the same discipline as our funded project was submitted.
17	Yes, a proposal for another project in a different discipline was submitted.
34	No, the proposal for our current project was the only one our institution has ever submitted to CAUSE.
12	No, not to my knowledge.

4a. Reviewers' comments requested and received on proposals that were *not* funded.

45%	Yes, the reviewers' comments were requested and received.
48	The reviewers' comments were requested but never received.
0	No, the comments were not requested.
6	No, not to my knowledge.

4b. *If the reviewers' comments were received, how were the comments used in preparing another CAUSE proposal?*

% of Total	% of Respondents	
24	33	Reviewers' comments used to rectify deficiencies in earlier proposal
23	32	This item is not applicable
12	16	Reviewers' comments used to change the emphasis of the proposal
10	13	Reviewers' criticisms were answered in proposals and/or unhelpful comments were ignored
5	7	Reviewers' comments were used to change the evaluation strategies
3	4	Reviewers' comments were used to increase institutional support of the proposal

5a. *Did you participate in the development of the proposal for your CAUSE project?*

97% Yes 3% No

5b. *If you answered "yes", how did you find out about the CAUSE program?*

% of Total	% of Respondents	
38	39	Office of research service, sponsored programs, grants management or grants officer
28	29	Visitors from NSF or NSF brochures, flyers
26	27	College administration
14	14	NSF briefing meeting
4	4	Prior experience with NSF
3	3	Faculty contacts
3	3	Faculty went out and looked for grant opportunities

6. Group(s) or individuals primarily responsible for the development of the proposal.

66%	Faculty group
28	One faculty member
15	Administrators
12	Other
1	Students

7a. Was more than one department or group of faculty interested in applying for a CAUSE grant?

48% Yes 53% No

7b. *If you answered "yes", how was it determined which department or groups would submit?*

% of Total	% of Respondents	
18	28	Cooperative combined effort
15	23	Criteria were established for determining the best proposal
14	21	Administrative decision
10	16	Not applicable or don't know
5	8	Submitting group was ready with a proposal first
5	8	Anyone interested could participate

8. *How were staff members selected to be involved in the CAUSE project?*

% of Total	% of Respondents	
33	33	Selected by subject area, expertise, teaching area, or position
28	29	Self-selected: anyone interested could participate
23	24	Selected by president, dean, department head or project director
16	16	Selected because of proven commitment and/or participation in proposal writing effort
3	3	Item not applicable
3	3	Those who thought the question referred to proposal writing activity

9. Project director's previous experience managing externally-funded projects in a higher education setting.

42%	Have managed at least one externally-funded instructional improvement project prior to CAUSE.
39	Have managed at least one externally-funded research project prior to CAUSE.
31	This CAUSE project is my first experience with project management.

10. Previous experience of project staff with instructional improvement projects.

1%	None of project staff has prior experience with instructional improvement projects similar to the CAUSE project.
42	Some of our project staff have prior experience with instructional improvement projects similar to the CAUSE project.
46	Most of our project staff have prior experience with instructional improvement projects similar to the CAUSE project.
11	More than one response.

11. *If you had been able to request additional outside assistance in planning your CAUSE project and preparing your CAUSE project proposal, what kind of assistance might have been helpful?*

% of Total	% of Respondents	
30	32	Didn't need any help
18	20	Needed help in organizing activities, staff time, budget
18	20	Needed to see successful proposals and/or CAUSE projects, project staffs
10	10	Needed outside consultants in areas not mentioned in other categories
8	9	Item not applicable
7	8	Needed help on evaluation
6	7	Needed help in understanding NSF policies/ guidelines
6	7	Needed help in proposal writing

12a. Accuracy of the original description in the proposal for each of the following project components.

	Very Accurate	Generally Accurate	Generally Inaccurate	Very Inaccurate	No Response
Project activities	55%	44%	1%	0%	0%
Project objectives and goals	58	41	1	0	0
Project management	43	54	2	0	1
Time tables or timelines	12	56	27	5	0
Budget	19	65	15	1	0
Evaluation plans	22	60	16	1	1
Impact of project	34	55	6	0	5

12b. *How has your project been modified during the operation to incorporate new findings and/or experience gained?*

% of Total	% of Respondents	
26	28	No changes or slight changes or changes as planned
19	20	Changes in implementation strategies, methods or activities
13	13	Changes in personnel or in staff roles
13	13	Changes in timelines
12	12	Modifications in equipment/facilities
12	12	Changes in software, materials
7	8	Changes in budget
7	8	Changes in computer equipment
5	6	Changes in goals or objectives
5	6	Changes in evaluation strategies or plan

13a. Importance of some activities to project success.

	Extremely Important	Important	Somewhat Unimportant	Totally Unimportant	Doesn't Apply or No Response
Project planning & management sessions	32%	51%	12%	2%	4%
Efforts to win support for our project at our institution	44	34	15	3	4
Working collaboratively with project staff	45	38	12	1	4
Working with students on the project	19	51	19	3	8

13a. (Continued)

	Extremely Important	Important	Somewhat Unimportant	Totally Unimportant	Doesn't Apply or No Response
Evaluating the project	26%	57%	14%	2%	1%
Designing instructional materials	58	31	4	1	6
Designing facilities & selecting equipment	50	34	7	1	8
Describing the project to others	17	53	25	3	2
Developing a new curriculum	20	38	21	3	18
Seeking financial support for the project once NSF funds are gone	20	40	21	7	12
Teaching (related to our project)	42	50	4	0	4
Working with lab technicians/ programmers, etc.	13	41	15	6	25
Working with non-project faculty	21	25	22	14	18

13b. *Are there other activities not identified above that are important to project success?*

% of Total	% of Respondents	
18	32	Communication/promotion of good relations with NSF, institution, students, dissemination
17	30	No other activities
11	19	Getting and keeping cooperation/participation of faculty and administration
5	9	Getting a good, committed staff
3	6	Use of outside consultants

14a. Have you described your project to someone from other institutions?

90% Yes   9% No   1% No response

14b. *If you did have the opportunity to describe your CAUSE project to someone at other institutions, what did you say was the most important outcome of your project?*

% of Total	% of Respondents	
24	27	Improved curriculum/upgraded program
19	21	Development of improved attitudes toward computers, computer-related materials
14	15	Improved equipment/facilities
14	15	Improved instructional options for students
12	13	Improved lab opportunities
10	11	Accommodations to student learning needs, especially non-science majors or slower learners
10	11	Improved student attitudes
8	9	Increased student learning
8	9	Improved faculty attitudes
5	6	No one most important outcome or not applicable or don't know
5	6	Upgraded or new faculty skills

15a. Seriousness of various difficulties which may arise on a CAUSE project.

	Critically Serious	Serious	Somewhat Serious	Not Serious At All	Doesn't Apply or No Response
Delay of formal approval of our project by NSF	0%	13%	25%	43%	19%
Confusion of responsibilities within our project	1	2	21	63	13
Insufficient attention given to project planning	1	1	14	62	22
Unclear decision-making policies on our project	0	2	12	67	19
Lack of necessary technical assistance	3	8	24	43	21
Short supply or delay of materials	5	8	27	46	13
Communication problems within our institution	7	6	25	51	10
Misunderstanding of project objectives by project personnel	1	4	16	66	13
Reluctance of important department or school administrators to commit themselves to project	6	10	22	53	9
Lack of attention given to problems of implementation by project staff	3	7	28	50	12
Conflicts among project personnel	3	10	71	17	0
Difficulties with our institution's rules and regulations	6	6	10	64	14
Difficulties with NSF's rules and regulations	0	0	7	80	13
Lack of sufficient time to complete planned activities	3	18	36	35	8

15a. (Continued)

	Critically Serious	Serious	Somewhat Serious	Not Serious At All	Doesn't Apply or No Response
Conflicting commitments on the part of project staff	3%	18%	36%	35%	8%
Budgetary problems	4	8	19	62	6
Securing matching funds	3	6	11	66	14

15b. *Are there other difficulties you have encountered in project implementation which we have not described above?*

% of Total	% of Respondents	
18	27	No other difficulties or not applicable
7	11	Lack of cooperation from faculty or some faculty
6	9	Changes in project staff
4	6	Delays in construction/renovation
4	6	Lack of cooperation from institution administration
4	6	Red tape in going through state, county, consortium channels

16. *What is the most serious difficulty your CAUSE project has encountered and how was it handled?*

% of Total	% of Respondents	
21	22	Delays; too little time; missed deadlines
13	13	Too little productivity, inter-personal conflicts, confusion over roles among project staff
13	13	Getting cooperation of affected faculty
12	12	Referred to an earlier question as containing the answer to this one

16. (Continued)

% of Total	% of Respondents	
8	9	Lack of cooperation by administration
8	9	Inadequate budget
6	7	Personnel changes
4	4	Acquisition of equipment/software/materials
4	4	None
3	3	Informing students of services

17. Areas of expertise that would have been helpful.

27%	Evaluation
23	Computer applications
15	Project management
13	Budget management
13	Instructional development
11	Other
8	Audiovisual media
8	Equipment ordering
8	Curriculum development
7	Science/social science content experts

18a. Are there incentives provided by your institution for working on CAUSE?

44% Yes 55% No 1% No Response

18b. *Are there incentives provided by your institution for working on the CAUSE project? If "yes", describe these incentives.*

% of Total	% of Respondents	
22	46	Release time for faculty working on project
16	33	Verbal encouragement; campus community recognition
7	15	Summer support/support for project-related activities

18b. (Continued)

% of Total	% of Respondents	
5	11	Stipend/merit raises
4	9	Don't know or not applicable
3	7	Counts toward promotion/tenure

18c. ***Are there incentives provided by your institution for working on the CAUSE project? If "no", what incentives would have been helpful for achieving the project goals?***

% of Total	% of Respondents	
17	31	Release time
12	22	Administrative recognition/encouragement
11	20	Financial incentives
7	14	Don't need incentives
6	12	Promotion/tenure
6	12	Item not applicable
4	8	Institutional help in bringing about smooth implementation
3	6	Additional staff

19a. ***How much faculty release time or replacement time has been covered full or part time by CAUSE monies?***

% of Total	% of Respondents	
64	64	Release time in academic year
24	24	No release time
15	15	Summer stipends

20a. *In your opinion how have faculty members at your institution changed as a result of the CAUSE project? Please describe briefly as to: What do you expect the change to be?*

% of Total	% of Respondents	
23	27	Faculty will learn how to develop curriculum, individualize instruction, develop materials
23	27	Faculty will develop more expertise and positive attitudes toward using/teaching computer
19	22	Faculty will improve teaching and interact with students more effectively
13	15	Faculty will learn content areas outside their own area of expertise
12	13	Faculty will engage in new experience (research, planning, proposal writing, teaching off campus) and will have an enhanced sense of professionalism
7	9	Faculty will cooperate better interdepartmentally
6	7	Faculty will benefit from improved facilities/ equipment

20b. *In your opinion, how have faculty members at your institution changed as a result of the CAUSE project? Please describe briefly as to: What impact has already been felt?*

% of Total	% of Respondents	
21	22	Faculty capabilities have been broadened and increased and faculty are engaging in new activities
20	21	Teaching effectiveness has been enhanced and faculty have a better relationship with students
16	17	Faculty have undertaken curriculum development projects
16	17	Faculty have increased use of computer and computer-related materials and/or improved attitudes toward computing
14	14	Faculty in target departments have responded/ shown interest
6	7	Faculty morale is improved
5	6	Faculty are benefiting from improved equipment/facilities

21a. *In your opinion, how have the science curriculum and/or some courses at your institution changed as a result of the CAUSE project? Please describe briefly as to: What do you expect the change to be?*

% of Total	% of Respondents	
27	28	Addition of special components/features to specific existing courses
17	17	Modifications or innovation in existing courses
16	16	Better options/services, opportunities for students
12	12	Development of new courses or kinds of courses
7	7	Improved instruction/faculty attitudes
6	6	Proposed activities are being implemented
5	5	Upgraded equipment/facilities implies improved curriculum
4	4	Higher student enrollment/interest
4	4	New/revised materials

21b. *In your opinion, how have the science curriculum and/or some courses at your institution changed as a result of the CAUSE project? Please describe briefly as to: What impact has already been felt?*

% of Total	% of Respondents	
19	22	Better options, services, opportunities for students
18	21	Addition of new components/features to existing courses
14	16	Development of new courses/sequences or kinds of courses
8	10	Proposed activities are being implemented
8	10	Too early or no observed impact or NA (no answer) or expectations not met
8	10	Higher student enrollment/interest

21b. (Continued)

% of Total	% of Respondents	
6	7	Improved instruction/faculty attitudes
5	6	Modifications or innovation in existing courses
5	6	New activities for faculty
5	6	New/revised materials
4	5	Upgraded equipment/facilities implies improved curriculum

22a. *In your opinion, how have science equipment and/or facilities at your institution changed as a result of the CAUSE project and have the changes had the effects you anticipated? Please explain as to: What do you expect the change to be?*

% of Total	% of Respondents	
22	26	New equipment, materials/facilities
20	23	Enable, bring about, instructional improvement
16	18	Upgrade, expand, improve equipment/facilities
13	15	Obtain new computer equipment
10	11	No impact/not applicable
8	10	Upgrade, expand, improve computer equipment
2	2	Improved faculty and/or student morale
2	2	Positive impact outside CAUSE project

22b. *In your opinion how have science equipment and/or facilities at your institution changed as a result of the CAUSE project? Please describe briefly as to: What impact has already been felt?*

% of Total	% of Respondents	
23	26	Enable, bring about improved instruction
14	16	New equipment, materials, facilities
11	12	No impact/not applicable
10	11	New computer hardware/software
10	11	Upgrade, expand, improve equipment/facilities
8	10	Proposed activities have been implemented
7	8	Positive impact outside CAUSE project
6	7	Improved faculty and/or student morale
5	6	Upgrade, expand, improve computer equipment

23a. *In your opinion how have students at your institution changed as a result of the CAUSE project? Please explain as to: What do you expect the change to be?*

% of Total	% of Respondents	
50	55	Improved training, student competency
20	22	Improved student attitudes toward target courses and the related disciplines
11	12	Higher student enrollments
10	11	Students are more proactive, participate more
3	4	Too early to tell or not applicable or don't know

23b. *In your opinion how have students at your institution changed as a result of the CAUSE project? Please explain as to: What impact has already been felt?*

% of Total	% of Respondents	
30	32	Improved training, student competency
21	23	Students are more proactive, participate more
16	17	NA or too early to tell or don't know or less impact than expected
14	15	Improved student attitudes toward target courses
10	10	Implementation of activities is proceeding/ students are changing or have changed
8	9	Higher student enrollments

24. *Have any unexpected changes occurred as a result of the CAUSE project? Please describe them.*

% of Total	% of Respondents	
20	24	None
16	19	Unexpected outcomes; spin-offs from CAUSE
11	13	Higher faculty use/acceptance than expected
8	10	Higher student use/acceptance than expected
7	9	General impact and/or impact on the community greater than expected
6	8	Faculty more involved in new activities than expected
4	5	More negative impacts than expected
3	4	Better faculty morale and collaboration than expected

25. *If you had the chance to start your CAUSE project over again, from the beginning, what would you do differently?*

% of Total	% of Respondents	
22	23	Better front-end planning
17	17	No changes
16	16	More release time and/or summer support for faculty and project staff
15	15	Increase budget
14	14	Make changes in staffing
12	12	Changes in strategies, activities, equipment
10	10	More faculty participation/cooperation
6	7	Better management
4	4	Change evaluation plan

26a. Have you sought or will you seek funding to continue CAUSE activities?

70% Yes   21% No   10% No response

26b. *Have you sought or will you seek funding from other sources to continue activities started under CAUSE? If "yes", from what sources will you seek funding?*

% of Total	% of Respondents	
30	39	NSF
28	38	Private foundations, individuals, corporations
20	26	Own institution
16	21	Don't know
12	15	Federal agencies other than NSF
4	6	State agencies

26c. *Have you sought or will you seek funding from other sources to continue activities started under CAUSE? If "no" will activities started as a part of the CAUSE project continue after CAUSE funding has ended?*

% of Total	% of Respondents	
38	100	Yes - can operate within college/university/ consortium budget

27. Evaluation can best be described as the following:

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Response
Evaluation is important to the institution in monitoring the effectiveness of projects of this type	39%	54%	5%	1%	1%
The best way to evaluate a CAUSE project is to have an expert(s) from outside our institution review our project outcomes	12	31	53	3	2
The primary reason evaluation is included in our project is mostly to meet CAUSE requirements for evaluation	7	28	48	15	1
A clear and thorough description of our project will meet CAUSE requirements for project evaluation	4	43	36	13	4
Evaluation results have been used to change some of the activities and/or outcomes of this project	20	48	20	2	10
Our project funds allocated for evaluation activities could be better spent on other project activities	5	22	53	14	6
Formal evaluation activities take up too much time, effort, and money on our CAUSE project	6	21	56	13	4

27. (Continued)

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Response
Negative evaluation results on our CAUSE project might jeopardize our institution's chance at further external funding for science instruction	2	16	57	12	14
Project evaluation means conducting activities which have little or no usefulness to our CAUSE project staff	0	12	67	20	1
Project evaluation is best accomplished and most highly useful when it is conducted internally by project personnel in an ongoing manner	18	54	22	2	4
The best way to conduct evaluation of our CAUSE project is to try to measure student achievement gains	6	37	44	4	8
Given the nature of our project, evaluation is really an irrelevant activity	0	8	55	34	3
Evaluation activities have not gone as planned	5	34	53	7	1
To do the kind of evaluation we would like, we need more money and staff	10	27	54	7	2
We are not qualified to do an internal evaluation of our project	1	12	63	22	2

28. *If you had the opportunity to suggest strategies for promoting project success to a prospective CAUSE project director, what would be your recommendation?*

% of Total	% of Respondents	
24	26	Make sure that management and authority issues are carefully worked out
21	23	Do careful front-end planning
18	20	Get the participation/commitment of the faculty
14	15	Get the cooperation/commitment of the administration
14	15	Implement carefully with attention to detail
11	12	Select staff carefully
7	8	Get release time for faculty and for staff development
6	7	Make sure communication is frequent and adequate
5	6	Be willing to dedicate yourself
3	3	Use evaluation formatively

29. *If you had the opportunity to advise a prospective CAUSE project director about CAUSE project evaluation, what would be your primary recommendation?*

% of Total	% of Respondents	
22	24	Use outside experts
20	22	Know what you want; be realistic; be satisfied with plan
13	14	Do formative evaluation
13	14	Use internal people for evaluation
11	11	Do objectives-based evaluation
6	7	Start early
3	3	Avoid traditional evaluation techniques

30. *If you had the opportunity to make one suggestion to the NSF-CAUSE program office to improve the CAUSE program, what recommendation would you make?*

% of Total	% of Respondents	
40	43	More/better communication, dissemination among projects and with NSF staff
21	23	None - doing a good job
7	8	More flexibility for project directors; less red tape
5	6	More funding/follow-up/changes
5	6	Better evaluation policy
4	5	Make changes in policies around awards
4	5	Institutional commitment should be assured
3	3	Reviewers should be in fields of subject of proposal or from same kind of institution
3	3	Institutions shouldn't be required to change/ modify to please NSF

CHAPTER TWO

CONTENT ANALYSIS OF FUNDED PROPOSALS, 1976-1979

Jody Karen Witham

Purpose of the Content Analysis

A content analysis of funded proposals was chosen as a broad focus evaluation activity because of its advantage in supplying data from available documents. As a result, there was no need to gather some kinds of information from individual sites. It also offers the opportunity to study the tenor of CAUSE projects prior to their implementation. These data can then be viewed in relationship to the other data collection activities, the surveys, site visits, and case studies.

The content analysis provides information relevant to certain aspects of the evaluation issues of concern. For example, proposals contain specification of institutional needs, institutional goals and objectives, and methodology of project implementation. Through the analysis of proposals, these areas were categorized and compared across such variables as project year and type of institution. Another function of the content analysis was to look at trends in science education as described by proposing institutions. Therefore, the primary purpose of the content analysis of funded proposals was to provide baseline data to support and drive other evaluation activities.

CAUSE proposals provide a valuable source of information about perceived needs and goals and the planned strategies for meeting the needs and achieving the goals. They are statements of what could be, and further what ought to be, in the eyes of proposers.

Derivation of Content Analysis Procedures

Introduction

The procedures for analyzing the funded CAUSE proposals were derived from two major sources. The Office of Program Integration (OPI) conducted an analysis of all CAUSE proposals submitted in 1976 and 1977 (Lewis, 1977). The study was an attempt to categorize the problems, needs, and related strategies described for solving the spectrum of problems in science education as seen by the proposing institutions. Subsequently, a team at DEA worked on the development of an analysis procedure which would clarify and expand upon that used by OPI. An explanation of both of these methods follows.

A Content Analysis Conducted by NSF

The OPI study was initiated by selecting independent variables by which to describe and analyze CAUSE proposals. These variables include institution type (Ph.D granting, baccalaureate granting, two-year college, and consortium) project funding years (1976, 1977), and institutional control (public, private). A random sample was drawn to provide proportional numbers of proposals in the four institutional categories. This set of randomly sampled proposals was then compared by year and by institutional control. Then, all funded proposals were analyzed together.

The analysis of proposals looked at four variables which are rather complex in nature. They are: intended audiences for proposed program; problem area; needs; and strategies. Proposals could be classified as fitting into more than one category for each variable. Category descriptions follow.

A category "intended audience for proposed program" identifies the recipients of CAUSE efforts. Possible classes of audiences are, inadequately prepared students; entry level (remedial); science majors in introductory courses, upper level courses, or undergraduate research; non-science majors only; and faculty. These intended audiences were compared between years and across institutional types. In summary form, four major problem areas are reported as:

1. Entering students inadequately prepared for college level work in science.
2. Curricula needing revisions and additions to keep pace with the current state of science education.
3. Teaching methods are not as effective or efficient as they should be.
4. Faculty members whose knowledge and skills need upgrading.

Major "needs" are distinguished from "problems" as identified above:

1. Remedial instruction
2. Faculty time for developing courses
3. Laboratories
4. Teaching materials and research projects
5. Equipment, facilities, and materials for laboratory work
6. Equipment and materials for instructional use
7. Workshops and study leaves for faculty members

Finally, a fourth category, "strategies" categorizes the types of projects proposed. Classes of strategies are:

1. Remediation
2. Curriculum revision
3. Laboratory equipment acquisition
4. Computer equipment/software

5. Equipment for instruction
6. Individualized instruction
7. Facilities and vehicles

The OPI document (Lewis, 1977) reports that half the proposers chose individualized instruction as a strategy for meeting needs and that half wanted assistance in upgrading computer hardware and/or software (categories not mutually exclusive). Other frequently cited strategies were: remediation (40%, 1976; 25%, 1977); curricular additions and revisions (66% of all proposals); laboratory equipment, construction or remodeling (50% of funded proposals in 1977); and faculty development, particularly in four-year colleges and especially for the development of skills in computer applications.

A final section of the report deals with the issue of reapplication in some detail. The number of reapplications in 1977 is discussed in relation to the proportion which were funded, and the funding levels for 1976 and 1977.

Content Analysis for this Evaluation

Category selection. The evaluation team at DEA made changes in the categories created by OPI in order to make the content analysis data more useful in the scheme of the total evaluation. New categories and subcategories were added while others were expanded to add detail or were collapsed for clarity. The development of a final set of categories has been the result of a long and careful team effort to produce categories that are not too ambiguous or overlapping, and which arise most naturally from data in the proposals. The major variables used in the content analysis are:

1. Institutional type
2. Discipline
3. Audience
4. Problems and needs
5. Goals and objectives
6. Outcomes

Each of these has been divided into categories and subcategories. All the categories and subcategories were chosen with the intent of maximizing inter-reader reliability in data collection.

Institution type and discipline. The first two variables, "institution type" and "discipline" are self-explanatory: institution types are exactly the same as those described by the OPI report -- two-year, four-year, Ph.D granting and consortium. Discipline includes the major disciplinary areas defined by NSF for use by the proposers.

Audience. The "audience" variable contains six categories which differ somewhat from those identified in the OPI study. This variable defines that group (or groups) for which the proposed project is meant. The six categories under audience are:

1. Faculty
2. Local community
3. Majors and Non-Majors: Introductory
4. Science Majors: Introductory
5. Science Majors: Advanced
6. Non-Science Majors

Problems and needs. As previously noted, the OPI report divided "problems" and "needs" into two categories where "needs" described the kind of intervention that has been identified as most likely to solve institutional problems and where "problems" meant an identifiable lack, an area requiring action. In our classification system, "problems and needs" have been collapsed into one variable which has the same focus as the "problems" section in the OPI report; that is, an identifiable lack. The categories under "problems and needs" which we identified are:

1. Curricula need revision/addition to keep pace with current state of science education.
2. Teaching methods are not as effective or efficient as they should be.
3. Faculty need to update knowledge or skills.
4. Missing/inadequate hardware, software, facilities.
5. Student problems necessitating curricular or instructional revisions.

It will be noted that this classification system is very similar to OPI's "problems" categories except that the student problems category is broader, allowing for greater inclusiveness, and there is the addition of the "missing/inadequate hardware, software, and facilities", a category that is covered in OPI's "needs" section.

Goals and objectives. The next major variable devised by DEA is called "goals and objectives". It is roughly equivalent to OPI's "needs" in that it identifies the desired approach to solving the problem or satisfying the need. It identifies, in other words, the purpose of the innovation. The categories are:

1. To accommodate students at their levels and for their needs.
2. To update curricula to keep pace with the current state of science education.
3. To improve teaching methods to make them more efficient or effective.

4. To provide for faculty development.

It will be noted that where OPI identified seven major desired approaches to solving problems, we have identified only four. We originally left out OPI's four categories which were related to equipment, materials, and laboratories and included them in our "problems and needs" section. However, as we analyzed the 1976-1978 group of proposals, we ended up writing goals and objectives related to equipment/facilities use and acquisition in the "other" column. As a result, when revising the content analysis categories for the 1979 analysis, we added a fifth category to "goals and objectives": equipment and facilities acquisition. Data in the tables reflect this addition.

Outcomes. Our final major variable is "outcomes". By "outcome" we mean the strategy or strategies chosen by an institution to meet its goals and objectives. To put it another way, the variable identifies, specifically, what the grant will be used to do. The categories are:

1. Faculty development
2. Remediation/individualized instruction
3. Curriculum addition/revision
4. Use of computers
5. Equipment/materials/facilities

These categories are roughly equivalent to those of OPI's "strategies". Our "equipment/materials/facilities" category includes "instructional materials" and "laboratory materials and facilities" as well as "vehicles". Further, "faculty development" is not a category included in OPI's strategies.

An additional analysis broke each outcome category into component parts (Tables 12-16). For example, we identified seven types of equipment, four types of facilities, and six types of construction or renovation efforts under the broad outcome subcategory, "equipment/materials/facilities". Under "faculty development", we looked for four types of outcomes of development, and three forms of training. Under "curriculum addition and revision", we identified six kinds of experience a new curriculum could provide and five levels of complexity of development beginning with materials development and progressing up to the creation of a new major or department. We also, in every outcome category, identified the specific disciplines at which an innovation was to be aimed.

Data Collection

We began the data gathering by creating check sheets which contained all the categories and subcategories listed above along with further delineations. Three team members read a group of proposals and rated them individually. We then met to determine how reliable our ratings were and to clarify the definitions of certain categories. Once definitions were established for each category, we divided up the proposals among readers with every tenth proposal analyzed by two readers. We exchanged proposals with another reader if we had a questionable proposal.

During the first stage of the content analysis, we collected and analyzed data from funded proposals from funding years 1976-1978. Subsequently, we analyzed 1979 proposals. Using what we had learned during the first analysis, we eliminated a few empty categories and added "equipment and facilities acquisition" to our "goals and objectives" category. In developing the original set of categories, it was assumed that equipment acquisition would not stand alone as a goal. However, in reviewing the first round of proposals, we often found institutions siting acquisition as a goal. It was also determined that equipment acquisition often consumed a significant portion of the budget. Hence, the category was added for the 1979 review. Other smaller subcategories were added to the components of the outcomes. All cross-tabluations were then recomputed and include all funded proposals from the four years, 1976-1979.

Results of the Content Analysis

The results of the content analysis are divided into three major sections. The first section presents the total frequencies of all of the content analysis variables. The second section analyzes the change in broad categories and sub-categories over project initiation years. The third section analyzes differences among institution types. In each section, tables are accompanied by a discussion of the most significant differences or changes.

Total Frequencies for All Variables

The first section of tables (4-16) show the total frequencies and percents (n=273) for all of the content analysis variables. These tables fall into three groups. The first group shows the demographic variables; the second group presents variables related to problems and needs, goals and objectives, and intended outcomes; and the third group contains the further analysis of individual outcome variables.

The demographic variables of CAUSE projects. In reviewing total frequencies and percents, several interesting points can be noted. Table 4, which depicts the funded projects by institution type, shows that almost one-half of all CAUSE grants (47%) have been given to four-year, baccalaureate granting schools, while very few (6%) were awarded to consortia. The following table (5) reports the major disciplinary focus of CAUSE projects. Of those aimed at a single discipline, the highest percentage fell in the area of life sciences; however, more than one-half (56%) of all projects fall in the multidisciplinary category. Table 6 portrays target audiences of CAUSE grants.

Table 4

Institution Type of CAUSE Projects

Frequencies and Percentages

Institution Type	All Funded Proposals f	All Funded Proposals %
Two-year College	67	25
Baccalaureate-granting College	124	45
Doctorate-granting University	65	24
Consortium	17	6
Total	273	100%

Table 5

Disciplinary Focus of CAUSE Projects

Frequencies and Percentages

Discipline	All Funded Proposals	
	f	%
Chemistry	17	6
Earth Science	5	2
Engineering	16	6
Life Science	39	14
Math	20	7
Physics	9	3
Social Sciences	14	5
Multidisciplinary	153	56
Total	273	100%

Table 6

Target Audiences of CAUSE Projects

Frequencies and Percentages

	All Funded Proposals	
Audiences[a]	f	%
Faculty	45	16
Community	9	3
Students		
Introductory: Majors and Non-majors	166	60
Introductory: Majors only	87	32
Advanced: Majors	132	48
Advanced: Non-majors	17	6
Total	273	100%

[a] Proposals may address more than one target audience. Therefore, numbers and percentages reflect a duplicated count. In the content analysis, the number of audiences that a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of audiences because very few proposals described more than three.

Because projects are generally aimed at more than one audience, we identified a maximum of three in conducting the content analysis. Therefore, frequencies and percents reflect a duplicated count. Funded proposals indicated that projects were primarily aimed at introductory majors and non-majors (60%) and advanced majors (48%). Conversely, only three percent of the proposals cited the community as a target audience while only six percent indicated advanced non-majors as a potential audience. Table 7 presents the final demographic variable analyzed, project funding. The most frequently cited funding category (NSF contribution plus institutional contribution) is $250,000 to $350,000.

The general project variables. Table 8 depicts major categories and sub-categories of problems and needs reflected in the 273 funded proposals. The most frequently cited categories were:

> Hardware and software are missing and/or laboratory or learning center facilities are inadequate (51%);
>
> Existance of student problems which necessitate curricular or instructional revisions (41%);
>
> The curriculum is in need of additions or revisions (40%).

Again, we assumed that projects might reflect more than one problem or need. Therefore, tabled figures reflect a duplicated count.

Table 9 presents the goals and objectives of the funded CAUSE projects. As previously explained, DEA did not originally create a category for equipment/facilities development in the goals and objectives section, but added that category in the 1979 analysis. Therefore, the "other" category (45%) includes equipment and/or facilities from the 1976-1978 proposals. The shift in this area will be more clearly seen when the data are analyzed over project initiation years. Of the remaining

Table 7

CAUSE Project Funding

Frequencies and Percentages

Source of Contribution and Funding Level	All Funded Proposals f	All Funded Proposals %
NSF Contribution		
Less than $50,000	23	8
$ 51,000 - 100,000	31	11
$101,000 - 150,000	50	18
$151,000 - 200,000	47	17
$201,000 - 250,000	107	39
$251,000 - 300,000[a]	14	5
Institutional Contribution		
Less than $50,000	56	21
$ 51,000 - 100,000	82	30
$101,000 - 150,000	71	26
$151,000 - 200,000	25	9
$201,000 - 250,000	12	4
$251,000 - 300,000	11	4
Over $300,000	15	5
Total	273	100%

[a] NSF funding up to $300,000 was only available during the first year of CAUSE, FY1976. Current limit is $250,000.

Table 8

Problems and Science Education Needs
Frequencies and Percentages

Problem or Need[a]	All Funded Proposals f	 %
Curriculum needs revision or additions due to:	109	40
Inadequate coverage	75	27
Changing goals	20	7
Other reasons	17	6
Teaching methods are not as efficient or effective as they should be	59	22
Faculty need to update knowledge or skills in the following areas:	40	15
Instructional techniques	9	3
Subject matter	6	2
Computer skills	28	10
Hardware and software are missing and/or facilities are inadequate	140	51
Student problems which necessitate curricular or instructional revisions due to:	111	41
Inadequate preparation of incoming students	53	19
Poorly motivated students	7	3
Poor success rate of students	25	9
Increasing diversity of the student population	54	20
Other problems or needs	10	3
Total	273	100%

[a] Proposals may address more than one problem or need. Therefore, frequencies and percentages reflect a duplicated count. In the content analysis, the number of problems or needs which a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of problems because very few proposals discussed more than three.

Table 9

Goals and Objectives of CAUSE Projects

Frequencies and Percentages

Goals and Objectives[a]	All Funded Proposals f	 %
To accommodate students at their levels and/or for their needs	61	22
To update curricula in order to keep pace with the current state of science education	125	46
To improve teaching methods in order to make them more efficient and effective	107	39
To provide for faculty development	61	22
Equipment and facilities acquisition (data on '79 only, n=72)	52	72
Other (includes equipment and facilities from 1976-1978)	123	45
Total	273	100%

---

[a] Proposals may address more than one goal or objective. Therefore, frequencies and percentages reflect a duplicated count. In the content analysis, the number of goals and objectives which a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of goals and objectives because very few proposals discussed more than three.

categories, two were most often cited:

> To update curricula in order to keep pace with the current state of science education (46%)
>
> To improve teaching methods in order to make them more efficient and effective (39%)

As before, we allowed a maximum of three categories of goals and objectives to be cited by each individual project. Therefore, figures reflect a duplicated count.

The major outcomes and primary outcome of all funded CAUSE projects are shown in Tables 10 and 11. In the first table, figures reflect counts of a maximum of three major outcomes while the second shows a primary outcome for each of the 273 funded projects. The three most frequently cited major outcomes were:

> Equipment, materials, and/or facilities (61%)
>
> Computer acquisition and/or applications (51%)
>
> Curriculum additions or revisions (49%)

However, the figures change somewhat when only primary outcomes are analyzed: the most frequently cited categories remain the same and occur in relatively similar proportions, but faculty development projects fall from 23% to 3%. This factor indicates the secondary nature of faculty development among the CAUSE projects.

In reviewing the consistency of response among this last group of tables, some interesting patterns emerge. For example, need for faculty skill and knowledge development was reflected in 40 of the proposals, while 61 institutions cite faculty development as a goal, and 63 mention it as an outcome. This seems to indicate that while faculty development is not regarded as a need or problem, it is often thought of as a solution to more general problems (most often student needs). It may also be the case that faculty development would occur as a result of changes in

Table 10

Outcomes of CAUSE Projects

Frequencies and Percentages

Outcome[a]	All Funded Proposals	
	f	%
Faculty Development	63	23
Individualized Instruction/Remediation	62	22
Curriculum Addition/Revision	134	49
Computer Acquisition/Applications	138	51
Equipment/Materials/Facilities	167	61
Total	273	100%

[a] Proposals often describe more than one outcome. Therefore, frequencies and percents reflect a duplicated count. In the content analysis, the number of outcomes which a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of outcomes because very few proposals described more than three.

Table 11

Primary Outcome of Each CAUSE Project

Frequencies and Percentages

	All Funded Proposals	
Primary Outcome[a]	f	%
Faculty Development	8	3
Individualized Instruction/Remediation	43	16
Curriculum Addition/Revision	77	28
Computer Acquisition/Application	67	24
Equipment/Materials/Facilities	75	27
Total	273	100%

[a] One primary outcome was listed for each project.

teaching methods or equipment/facilities acquisition or adaptation. More projects cited curriculum additions or revisions as an outcome (n=134) than as a need (n=109). Again, this indicates the utilization of curricular change to solve other types of problems. In tabulating responses, we also found many institutions citing student problems but suggesting computer acquisition or equipment and materials acquisition as objectives and outcomes. This again reflects the pattern of using a variety of means to solve student problems.

Further analysis of outcome categories. The tables in this group, (12-16) represent the breakdown of each outcome category into its component parts. Frequencies of occurrence are given along with two sets of percents. The first set is based on the number of projects citing that outcome, and the second set come from dividing the frequency by the total number of funded projects (n=273). This discussion refers to the first set of percents as they most closely reflect the emphasis and direction of projects which identified that particular outcome.

The 63 faculty development projects (Table 12) indicated a primary interest in training staff in the use of computers (57%) and the use of instructional technology (52%). Most of the training was slated to occur on campus (71%), sometimes utilizing an outside consultant (27%). Most projects intended to provide training either during summer vacation (40%) or through the provision of release time (59%), indicating an understanding of the outcome of training added to existing responsibilities.

Individualization/Remediation projects are described in Table 13. Of the 76 proposals in this category, 32% mentioned remediation as a goal; the remainder fall into the individualization category. Individualization was to be aimed primarily at introductory classes and labs

Table 12

Faculty Development Projects

Components	% of Specified Cases[a] f	(n=63) %	% Total (n=273)
Faculty Time			
Summer vacation	25	40	9
Release time	37	59	14
On own time	11	17	4
Combination	5	8	0.02
In Order To			
Train in use of instructional technology	33	52	12
Update knowledge of subject area	12	19	4
Encourage research/publications/ professional growth	4	6	0.02
Train in use of computers	36	57	13
Other	15	24	5
Training Activities			
Off-campus training	17	27	6
Visiting consultant	17	27	6
On-campus training	47	71	17
Combination			
Disciplines			
Chemistry	42	67	15
Earth science	18	29	6
Engineering	12	19	4
Life science	35	55	13
Math	34	54	13
Physics	29	46	11
Social science	36	57	13

---

[a] Specified cases are those proposals which cited Faculty Development as one of the three listed outcomes.

Table 13

Individualization/Remediation Projects

	% of Specified Cases[a]		% Total
	f	%	
Components	(n=76)		(n=273)
Level of Instruction			
Remediation-type of problem	24	32	9
Entering deficiencies: Basic skills	19	25	7
Entering deficiencies: Science skills	15	20	5
Need for ongoing remediation	14	18	5
Introductory classes/labs	41	54	15
Upper level classes/labs	10	13	8
Non-science majors only	0	0	0
Type of Project/Instructional Medium			
CAI modules, units	26	47	10
Audiovisual/Audiotutorial	65	86	24
Print materials	17	22	6
Tutoring personnel	7	9	3
Course including all above	6	8	2
Other	4	5	1
Source of Materials			
Revision	5	7	2
Purchase	17	22	6
Development	29	38	11
Mixture	21	28	11

(cont'd next page)

Table 13 (cont'd)

Components	% of Specified Cases[a] f	(n=76) %	% Total (n=273)
Institutional Experience			
Experience evident	26	47	10
First experience	2	3	0.7
Cannot tell	16	21	6
Disciplines			
Chemistry	30	39	11
Earth science	11	14	4
Engineering	8	11	3
Life science	33	43	12
Math	24	32	9
Physics	23	30	8
Social science	11	14	4

[a] Specified cases are those proposals which cited Individualization/Remediation projects as one of the three listed outcomes.

(54%). For both remediation and individualization, the primary instructional medium was audio-visual or audio-tutorial (86%), with the next most cited medium being computer-assisted modules or units (90%). Institutions planned to develop their own materials in 38% of the cases and 47% indicated prior experience with individualized programs.

Table 14 presents the components of the 134 proposals identifying curriculum additions or revisions as an outcome of their CAUSE project. An analysis of these components shows that additions and revisions were almost evenly divided among the 134 projects, (53% additions, 57% revisions). The overlap, 10%, indicated the number of institutions putting equal effort into additions and revisions. Primarily these curriculum changes were initiated in an attempt to provide new content (51%), lab and field experience (41%), and the addition of new instructional strategies (34%). The development activities were generally at the level of curriculum development involving coordinated courses (41%) and curriculum materials development and purchase (45%). However, in most cases, materials acquisition was done in support of other development activities.

Of the 138 proposals identifying use of computers as an outcome (Table 15), 96% indicated an intention to purchase new or auxiliary equipment. The purchase and/or development of software was a component of most of the projects (89%). These materials were slated to be utilized in all science courses in 57% of the cases, and would be used primarily for lab simulation and computer-assisted instruction (54% in each case). Forty-three percent of the computer projects identified faculty development for computer applications.

The components of equipment and facilities projects are broken out

Table 14

Curriculum Addition/Revision Projects

Components	% Of Specified Cases[a] f	 %	% Total
	(n=134)		(n=273)
Addition or Revision			
Addition	71	53	26
Revision	77	57	28
To Provide			
New content	77	51	28
New instructional strategy	46	34	17
Problem solving skills	23	17	8
Lab/field experience	56	41	21
Career information/skills	12	9	4
Other	16	12	6
Level of Addition/Revision			
New major/department	9	7	3
Curriculum development-coordinated courses	56	41	21
Course development-not coordinated	22	16	8
Course development-single course	13	10	5
Materials development/purchase	62	46	23
Level			
Introductory	111	82	41
Upper level	76	56	28
Non-science majors only	9	7	3
Remedial	5	4	2
Disciplines			
Chemistry	66	49	24
Earth science	34	25	12
Engineering	24	18	9
Life science	70	52	26
Math	50	37	18
Physics	48	36	18
Social science	35	26	13

[a] Specified cases are those proposals which cited Curriculum Addition or Revision as one of the three listed outcomes.

Table 15

Use of Computer Projects

Components	% of Specified Cases[a] f	(n=138) %	% Total (n=273)
Uses			
Hardware acquisition			
Computer	133	96	49
Addition of terminals	23	17	8
Micro-processors	101	73	37
Purchase of time/timesharing	24	17	9
Software/purchase/development	123	89	45
For introductory courses (data for '79 only - n=42)	21	50	--
For upper level courses	25	18	9
For all science courses	79	57	29
For remedial courses	12	9	4
As used for:			
Lab simulation	75	54	27
CAI/CMI	74	54	27
Testing/scoring	15	11	5
Lab research	35	25	13
Faculty development for computer application	60	43	22
Disciplines			
Chemistry	85	62	31
Earth science	33	24	12
Engineering	30	22	11
Life science	71	51	26
Math	74	54	27
Physics	72	52	26
Social science	60	43	22

[a] Specified cases are those proposals which cited computer acquisition and application as one of the three listed outcomes.

in Table 16. Sixty-two projects indicated a desire to purchase science lab equipment. Learning lab equipment (carrels, etc.) was a purchase identified by 34% along with audio-visual hardware and software at 41% and 44% respectively. (It is assumed that this equipment would be utilized most often in a learning center setting.)

Table 16

Equipment and Facilities Projects

	% of Specified Cases[a]		% Total
	f	%	
Components	(n=167)		(n=273)
Nature of Equipment			
Video hardware	34	20	12
Video software	30	18	11
Audiovisual hardware	69	41	25
Audiovisual software	74	44	27
Learning lab equipment	56	34	34
Science lab equipment	103	62	38
Print materials (1979 data only, n=40)	14	35	--
Levels of Use			
Remedial	24	14	9
Introductory	128	77	47
Upper level	83	50	30
Non-majors only	7	4	3
Nature of Facilities			
New construction	22	13	8
Remodeling	79	47	29
Vehicles	11	7	4
Model construction	2	1	0.7
Type of Construction/Renovation			
Science lab	50	30	18
Learning lab	50	30	18
Telescope	2	1	0.7
Special models	1	0.6	0.4
Field station	19	11	7
Computing center	6	4	2
Other	18	11	7
Equipment Use (1979 data only, n=40)			
Library/resource center	3	8	--
Laboratory	18	45	--
Classroom	5	13	--
Learning lab	19	48	--

Table 16 (cont'd)

Components	% of Specified Cases[a] f	(n=167) %	% Total (n=273)
Disciplines			
Chemistry	69	41	25
Earth science	31	19	11
Engineering	21	13	8
Life science	97	58	37
Mathematics	34	20	12
Physics	49	29	18
Social science	32	19	12

[a] Specified cases are those proposals which cited equipment and facilities acquisition as one of the three listed outcomes.

An Analysis of Variables Over Project Years

This section presents an analysis of the demographic and general project variables as they shift over project initiation years. The discussion is related to Tables 17 to 24. Percentages shown in the tables are based on the frequency of the variable for that year, divided by the number of projects for that year, multiplied by 100. Numbers of projects increase somewhat from 1976 to 1978 (1976=59, 1977=68, 1978=74) and level off in 1979 (n=72).

The demographic variables. Table 17 shows the percentage of projects by year which were given to four types of institutions. This table shows that the relative percentage of projects across institution types remained similar. There was an increase in projects in doctorate-granting institutions in 1979 (20% to 30%) and a corollary decrease in projects in baccalaureate-granting schools (52% to 42%). Disciplinary focus across years is shown in Table 18. From 1976 to 1979, the single discipline focused projects spread out more evenly over categories while the percentage of multidisciplinary projects remained relatively stable. The most radical shift in Table 19, which portrays target audience, was in the area of introductory students. The percentage of projects indicating projects aimed at both introductory majors and non-majors dropped from a high of 70% in 1978 to a low of 50% in 1979, while projects aimed solely at majors at the introductory level grew from a low of 12% in 1977 to a high of 75% in 1979. This seems to indicate a shift of emphasis to majors over non-majors in general. The three most interesting shifts in the next table on funding (Table 20) are the NSF contribution at the levels of $200,000 and $250,000 and the institution contribution at the less than $50,000 category. The NSF contribution category of $250,000 to $300,000 was only

Table 17

Institution Type of CAUSE Projects

Percentages by Project Year

	% of Specified Cases			
Institution Type	1976	1977	1978	1979
Two-year College	27	27	23	22
Baccalaureate-Granting College	48	41	52	42
Doctorate-Granting University	22	21	20	30
Consortium	3	10	5	6
n of cases by year	n=59	n=68	n=74	n=72

Table 18

Disciplinary Focus of CAUSE Projects
Percentages by Project Year

Discipline	% of Specified Cases 1976	1977	1978	1979
Chemistry	5	7	4	8
Earth Science	2	2	1	3
Engineering	5	6	4	8
Life Science	22	12	14	11
Math	7	3	5	14
Physics	5	4	4	0
Social Science	0	6	8	6
Multidisciplinary	54	60	59	50
n of cases by year	n=59	n=68	n=74	n=72

Table 19

Target Audiences of CAUSE Projects

Percentages by Project Year

Audience[a]	1976	1977	1978	1979
	% of Specified Cases			
Faculty	9	15	23	18
Community	0	6	1	6
Students				
Introductory: Majors and Non-majors	60	66	70	50
Introductory: Majors only	17	12	20	75
Advanced: Majors	42	40	57	53
Advanced: Non-majors	10	10	0	4
n of cases by year	n=59	n=68	n=74	n=72

[a] Proposals may address more than one target audience. Therefore, numbers and percentages reflect a duplicated count. In the content analysis, the number of audiences that a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of audiences because very few proposals described more than three.

Table 20

CAUSE Project Funding

Percentages by Project Year

Source of Contribution and Funding Level	% of Specified Cases			
	1976	1977	1978	1979
NSF Contribution				
Less than $50,000	17	10	5	3
$ 51,000 - 100,000	10	13	12	10
$101,000 - 150,000	17	24	16	16
$151,000 - 200,000	10	16	19	22
$201,000 - 250,000	22	35	47	49
$251,000 - 300,000[a]	24	0	0	0
Institutional Contribution				
Less than $50,000	41	21	14	11
$ 51,000 - 100,000	29	35	27	29
$101,000 - 150,000	19	28	30	26
$151,000 - 200,000	2	9	12	13
$201,000 - 250,000	2	2	7	7
$251,000 - 300,000	5	1	5	4
Over $300,000	3	3	5	10
n of cases by year	n=59	n=68	n=74	n=72

[a] NSF funding up to $300,000 was only available during the first year of CAUSE, FY1976. Current limit is $250,000.

filled in 1976 (24%) while the $201,000 to $250,000 category increased from 22% to 49%. This shift occurred as a result of NSF's discontinuation of the $300,000 funding category after 1976. The institutional contribution category of less than $50,000 decreases from 41% to 11%, indicating greater proportions of contribution from institutions over project years.

The general project variables. Table 21 depicts the major categories and sub-categories of problems and needs reflected in the funded proposals across project years. The most interesting shifts over years were:

> An increase in proposals indicating their curriculum is in need of additions or revisions (from 34% in 1976 to 46% in 1979)
>
> An increase in missing or inadequate hardware, software and facilities (from 42% in 1976 to 54% in 1979)
>
> A decrease in student problems identified (from 53% in 1976 to 33% in 1979)

These shifts seem to indicate a change in project emphasis from student problems to curriculum development and hardware needs.

In the area of goals and objectives (Table 22) the shifts in categories over project years were:

> An initial decrease in numbers of projects intending to accommodate students at their levels and for their needs from 1976 to 1978 (32% to 15%) and then a rapid rise in 1979 to 28%.
>
> An increase in the 1979 data gathered on equipment and facilities at 72% over the "other" category which contains the equipment and facilities data from 1976-1978 (average of 58%).

The next two tables (23 and 24) present the major and primary outcomes of funded CAUSE projects over project initiation years. The major outcome figures reflect a maximum of three choices per proposal while the primary outcomes are limited to one per proposal. The categories under major outcomes showed some changes:

Table 21

Problems and Science Education Needs

Percentages by Project Year

	% of Specified Cases			
Problem or Need[a]	1976	1977	1978	1979
Curriculum needs revision or addition due to:				
Inadequate coverage	34	36	42	46
Changing goals	3	4	11	10
Other reasons	7	7	5	6
Teaching methods are not as efficient or effective as they should be	20	15	24	26
Faculty need to update knowledge or skills in the following areas:				
Instructional techniques	2	3	2	6
Subject matter	7	2	1	0
Computer skills	5	6	15	14
Hardware and software are missing and/or facilities are inadequate	42	47	46	54
Student problems which necessitate curricular or instructional revisions due to:				
Inadequate preparation of incoming students	27	13	16	22
Poorly motivated students	2	4	1	3
Poor success rate of students	10	6	10	11
Increased diveristy of student population	27	16	20	17
Other problems and needs	10	10	10	13
n of cases by year	n=59	n=68	n=74	n=72

[a] Proposals may address more than one problem or need. Therefore, frequencies and percentages reflect a duplicated count. In the content analysis, the number of problems or needs which a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of problems because very few proposals discussed more than three.

Table 22

Goals and Objectives of CAUSE Projects

Percentages by Project Year

Goals and Objectives[a]	% of Specified Cases 1976	1977	1978	1979
To accommodate students at their levels and/or for their needs	32	16	15	28
To update curricula in order to keep pace with the current state of science education	41	46	47	49
To improve teaching methods in order to make them more efficient and effective	41	43	43	31
To provide for faculty development	17	16	30	25
Equipment and facilities acquisition (data on '79 only)	--	--	--	72
Other (includes equipment and facilities from 1976-1978)	59	60	54	8
n of cases by year	n=59	n=68	n=74	n=72

[a] Proposals may address more than one goal or objective. Therefore, frequencies and percentages reflect a duplicated count. In the content anlaysis, the number of goals or objectives which a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of goals and objectives because very few proposals discussed more than three.

Table 23

Outcomes of CAUSE Projects

Percentages by Project Year

Outcome[a]	% of Specified Cases 1976	1977	1978	1979
Faculty Development	17	21	27	26
Individualized Instruction/Remediation	38	16	19	21
Curriculum Addition/ Revision	49	50	47	50
Computer Acquisition/ Applications	32	44	64	58
Equipment/Materials/ Facilities	71	65	55	56
n of cases by year	n=59	n=68	n=74	n=72

[a] Proposals often describe more than one outcome. Therefore, frequencies and percents reflect a duplicated count. In the content analysis, the number of outcomes which a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of outcomes because very few proposals described more than three.

Table 24

Primary Outcome of Each CAUSE Project

Percentages by Project Year

Primary Outcome[a]	% of Specified Cases			
	1976	1977	1978	1979
Faculty Development	0	5	3	4
Individualized Instruction/Remediation	21	15	15	14
Curriculum Addition/ Revision	25	32	27	29
Computer Acquisition/ Application	20	16	31	29
Equipment/Materials/ Facilities	34	31	23	23
n of cases by year	n=59	n=68	n=74	n=72

[a] One primary outcome was listed for each project.

An increase in faculty development as an outcome (from 17% in 1976 to 26% in 1979)

A downward trend in the number of projects identifying individualization and remediation as outcomes (from 38% to 21%)

An increase in computer applications (32% to 58%); a decrease in other equipment acquisition (71% to 56%). This seems to indicate that more projects are attempting to improve instruction via computer use rather than through learning and science lab improvements.

The same equipment shift appears in the primary outcomes:

Computer acquisition up from 20% to 29%.

Equipment acquisition down from 34% to 23%.

In conculusion, it appears that the major shifts over years of project initiation have been a decrease in focusing on instructional problems and needs in students and an increase in attention to strategies of instructional change and the addition of computer capabilities.

An Analysis of Variables By Institution Type

This section presents an analysis of differences among variables based on their relationship to the type of proposing institution. The first portion of this discussion briefly profiles each of the four institution types: two-year colleges, baccalaureate-granting institutions, Ph.D. granting institutions, and consortia. The second part of this section presents an overview of the major differences among institution types. Tables 25 to 31 are the focus of this section. Again, statistics are computed based on the frequency of each variable divided by the number of CAUSE projects of each institution type (i.e., 2-year, n=67; 4-year, n=124; Ph.D., n=65; and consortia, n=17).

Four-year Colleges. Looking first at baccalaureate-granting institutions which make up 45% of the funded institutions, Table 25 shows that the greatest percentage of multidisciplinary projects were at four-year institutions (70%). Table 26, which presents the target audience of CAUSE projects by institution type, shows that four-year schools were primarily interested in serving introductory students (65%) and advanced majors (60%). The most frequently cited problems and needs (Table 28) were in the areas of curriculum needing addition or revision (42%) and missing hardware and/or facilities (60%). Table 29 presents goals and objectives and shows the most often mentioned goal to be updating curriculum to keep pace with the current state of science education (49%), while in 1979, four-year colleges cited equipment and facilities acquisition in 70% of the funded proposals. Curriculum additions (Table 31) were cited as a primary outcome in 51% of four-year college proposals while computer acquisition and equipment/materials/facilities followed at 29% and 24% respectively.

Two-year Colleges. Two-year colleges, which received 25% of CAUSE project funding, were interested in helping introductory students (77%, Table 27). Nineteen percent of all two-year institutions cited life science as their disciplinary focus (Table 25). The most frequently mentioned problem or need was student problems at 57% with the most often cited subcategories being increasing diversity of the student population and inadequate preparation of incoming students at 33% and 27% respectively. The goals and objectives of two-year colleges were usually improving teaching methods (48%) and equipment and facilities acquisition (88%, 1979 data only). The two primary outcomes cited were again equipment and facilities acquisition (37%) and individualized instruction (24%) indicating the intention to solve student problems with instructional and equipment improvements.

Ph.D.-granting Institutions. Doctoral institutions aimed their projects at advanced majors (60%) and introductory students (65%), and most often cited curriculum needing additions or revisions and student problems as problems and needs (48% and 40% respectively). Updating the curriculum and equipment/facilities acquisition were frequently mentioned goals and objectives at 54% and 64% (1979 data only). Ph.D.-granting institutions intended curriculum additions or revisions to be a primary outcome of their projects.

Consortia projects, which represent 6% of all CAUSE projects most often mentioned curriculum needing additions or revisions and missing or inadequate hardware as problems and needs (53% and 47% respectively). Their goal was to acquire equipment and facilities (75%, 1979 data only) while 41% mentioned updating curriculum as a proposed goal. The two primary outcomes were computer acquisition or application and equipment/materials/facilities acquisition or improvements, both at 35%.

Major differences among institution types. Several categories within variables are interesting for the differences among institution types. As shown in Table 26, projects were more often aimed at faculty in four-year institutions and consortia (24%and 29%) than two-year colleges and Ph.D.-granting institutions (9% and 8%). Ph.D. institutions had proportionally higher budget projects than any of the other three institution types (Table 27). Faculty were cited as needing help more often in four-year schools and consortium projects than in either of the other two types of institutions, a carry-over from the target audience category. Inadequate hardware and facilities was cited most often by four-year institutions, while student problems were least often mentioned as problems and needs (10%) indicating a greater interest in improving equipment and facilities in four-year institutions. On the other hand, student problems were most often cited by two-year colleges (57%) while curricular inadequacy was much less of an issue (25%), a possible indication of the mission of two-year institutions to educate a broader spectrum of students. This same difference is represented in Table 29 which shows that two-year institutions maintained a higher interest in improving teaching methods (48%) and equipment and facilities (88%) than in curricular improvements (33%), while four-year colleges and Ph.D.-granting schools more often cited a goal of curriculum improvement (49% and 54%, respectively).

In the area of project outcomes, some of the conclusions previously discussed receive further support. Table 30 presents outcomes of the

CAUSE projects by institution type. A maximum of three could be listed for any institution (see note). Faculty development, which was often directed toward curricular and instructional improvement activities, was most often mentioned by four-year institutions which also cited curriculum change as an intended outcome. Two-year colleges cited equipment and facilities acquisition more often than any other institution type (73%) while mentioning curriculum change less frequently than any of the others (39%). Computer applications were also cited least often by two-year colleges who more often needed science and learning lab equipment.

Table 25

Disciplinary Focus of CAUSE Projects

By Type of Institution

	% of Specified Cases			
Discipline	2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
Chemistry	9	5	6	6
Earth Science	0	1	3	12
Engineering	4	4	12	0
Life Science	19	11	15	12
Math	9	5	9	12
Physics	4	1	5	12
Social Science	4	3	9	6
Multidisciplinary	50	70	40	41
n of cases	n=67	n=124	n=65	n=17

Table 26

Target Audience of CAUSE Projects

By Type of Institution

Audience[a]	% of Specified Cases 2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
Faculty	9	24	8	29
Community	4	3	3	6
Students				
Introductory: Majors and Non-majors	77	65	65	59
Introductory: Majors only	25	23	32	29
Advanced Majors	16	60	60	59
Advanced Non-majors	6	6	6	6
n of cases by institution	n=67	n=124	n=65	n=17

[a] Proposals may address more than one target audience. Therefore, percentages reflect a duplicated count. In the content analysis, the number of audiences that a proposal could be listed as addressing was limited to three.

Table 27

CAUSE Project Funding

By Type of Institution

Source of Contribution and Funding Level	% of Specified Cases			
	2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
NSF Contribution				
Less than $50,000	15	7	3	17
$ 51,000 - 100,000	15	12	6	12
$101,000 - 150,000	18	24	9	12
$151,000 - 200,000	22	18	8	23
$201,000 - 250,000	28	33	65	29
$250,000 - 300,000[a]	1	0	9	5
Institutional Contribution				
Less than $50,000	28	22	11	23
$ 51,000 - 100,000	36	35	15	23
$101,000 - 150,000	27	23	28	35
$151,000 - 200,000	3	6	22	5
$201,000 - 250,000	3	4	8	0
$251,000 - 300,000	0	2	12	5
Over $300,000	3	7	5	5
n of cases by institution	n=67	n=124	n=65	n=17

[a] NSF funding up to $300,000 was only available during the first year of CAUSE, FY 1976. Current limit is $250,000.

Table 28

Problems and Science Education Needs By Type of Institution

	% of Specified Cases			
Problem or Need[a]	2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
Curriculum needs revision or addition due to:	25	42	48	53
Inadequate coverage	13	32	32	29
Changing goals	6	5	12	12
Other reasons	6	5	7	12
Teaching methods are not as effective or efficient as they should be	27	17	25	24
Faculty need to update knowledge or skills in the following areas:	6	23	9	12
Instructional techniques	2	2	8	0
Computer skills	3	15	5	18
Subject matter	0	4	0	0
Hardware and software are missing and/or facilities are inadequate	39	60	34	47

(cont'd next page)

Table 28 (cont'd)

Problem or Need[a]	% of Specified Cases 2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
Student problems necessitate curricular or instructional revisions due to:	57	10	40	24
Inadequate preparation of incoming students	27	19	15	6
Poorly motivated students	6	2	0	6
Poor success rate of students	16	10	2	6
Increasing diversity of student population	33	10	28	6
Other problems or needs	13	10	9	12
n of cases by institution	n=67	n=124	n=65	n=17

[a] Proposals may address more than one problem or need. Therefore, the percentages reflect a duplicated count. In the content analysis, the number of problems or needs that a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of problems and needs as very few proposals described more than three.

Table 29

Goals and Objectives for CAUSE Projects
By Type of Institution

Goals and Objectives[a]	% of Specified Cases 2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
To accomodate students at their levels and/ or for their needs	33	18	25	6
To update curricula in order to keep pace with the current state of science education	33	49	54	41
To improve teaching methods in order to make them more efficient or effective	48	36	38	29
To provide for faculty development	13	33	14	12
Equipment and facilities acquisition (data on 1979 only)	88 (n=16)	70 (n=30)	64 (n=22)	75 (n=4)
Other (includes equipment and facilities from 1976-1978)	48	44	40	58
n of cases by institution	n=67	n=124	n=65	n=17

[a] Proposals may address more than one goal or objective. Therefore, the percentages reflect a duplicated count. In the content analysis, the number of goals or objectives that a proposal could be listed as addressing was limited to three. This did not eliminate a significant number of goals and objectives as very few proposals cited more than three.

Table 30

Outcomes of CAUSE Projects By Type of Institution

	% of Specified Cases			
Outcomes[a]	2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
Faculty Development	16	31	15	24
Individualized Instruction/Remediation	30	18	29	0
Curriculum Additions/ Revisions	39	54	52	41
Computer Acquisition/ Applications	37	56	51	59
Equipment/Materials/ Facilities	73	52	66	59
n of cases by institution	n=67	n=124	n=65	n=17

[a] Proposals often cited more than one anticipated outcome. Therefore, the percentages reflect a duplicated count. In the content analysis, the number of outcomes which a proposal could be listed as having was limited to three. This did not eliminate a significant number of outcomes as very few proposals cited more than three.

Table 31

Primary Outcome of Each CAUSE Project By Type of Institution

	% of Specified Cases			
Primary Outcome[a]	2-Year College	Baccalaureate Granting	Ph.D. Granting	Consortium
Faculty Development	1	4	3	6
Individualized Instruction/Remediation	24	11	20	0
Curriculum Additions/ Revisions	18	31	35	24
Computer Acquisition/ Applications	19	29	18	35
Equipment/Materials/ Facilities	37	24	23	35
n of cases by institution	n=67	n=124	n=65	n=17

[a] One primary outcome was determined for each project.

REFERENCES

Diamond, R. M., Eickmann, P. E., Kelly, E.F., Holloway, R. E., Vickery, T. R., & Pascarella, E. T. Instructional development for individualized learning in higher education. Englewood Cliffs, NJ: Educational Technology, 1975.

Durzo, J. J. Instructional development in the New Hampshire College and University Council: The creation of a setting. (Doctoral dissertation, Syracuse University, 1976).

Holsclaw, J. E. The development of procedural guidelines for the systematic design of instruction within higher education (Doctoral dissertation, University of Southern California, 1974). Dissertation Abstracts International, 1974, 35, 1873-A. (University Microfilms No. 74-21,479)

Lewis, P. A. Analysis of CAUSE proposals (draft). Washington, D.C.: National Science Foundation, Office of Program Integration, 1977.

Nie, N. H., Hull, D., Jenkins, J., Steinbrennan, K., and Brent, D. SPSS: Statistical package for the social sciences (2nd ed.). New York: McGraw-Hill, 1975.